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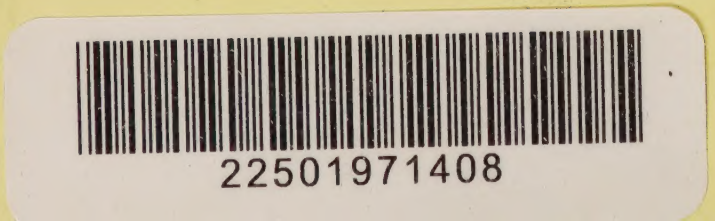

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PUBLIC HEALTH.

REPORTS

OF

THE MEDICAL OFFICER OF THE PRIVY COUNCIL AND LOCAL GOVERNMENT BOARD.

NEW SERIES, No. VII.

ANNUAL REPORT TO THE LOCAL GOVERNMENT BOARD WITH REGARD TO THE YEAR 1875.

Presented pursuant to Act of Parliament.

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REPORT.

TO THE RIGHT HON. GEORGE SCLATER-BOOTH, M.P.,
PRESIDENT OF THE LOCAL GOVERNMENT BOARD.

MEDICAL OFFICER'S REPORT.

SIR,

I HAVE the honour of submitting to you my Report of the proceedings which in the year 1875 you directed to be taken through the Medical Department of the Local Government Board in matters concerning the Public Health.

I. A large part of the proceedings consisted as previously, and as was explained at some length in my last year's Report, in the inspection of Public Vaccination, with other superintendence of the action of the local authorities and officers who are charged with duties under the Vaccination Acts.

1. Under the system which the Lords of the Council established, and which has been continued under the Local Government Board, each ordinary vaccination-district of England is visited by one of the Inspectors of this Department once in every two years*; but in the year 1874 (as I had to mention in my last year's Report) it had happened that this customary inspection was, from accidental causes, considerably interrupted; and as it was necessary in 1875 to deal with the arrears which had thus arisen, the quantity of vaccination-inspections done during 1875 was to that extent in excess of an average yearly amount. The inspections of the former year had extended only to 1,357 vaccination-districts, comprised in 275 Unions and non-united parishes; but those of 1875 extended to 1,782 vaccination-districts comprised in 371 unions and parishes. In Appendix No. 1 I enumerate the unions and parishes which were inspected as above, and give particulars as to the awards of money which were made in each case to the public vaccinators, under § 5 of the Vaccination Act of 1867, out of the grant provided by Parliament for this purpose. The awards actually made amounted to 15,676*l.*; but a portion of this amount, probably about 2,500*l.*, represented the accidental excess of the vaccination-inspections of 1875 beyond the average yearly number.

2. The success of our modern vaccination-laws in enforcing the general vaccination of infants is to be measured by the periodical returns which are made to the Board, under the Act of 1871, by the so-called vaccination-officers throughout the country. Of such returns the first collection, which related to children born in the

* A few districts are, for special reasons, visited every year.

year 1872, was completed early in 1874, and a digest of it, prepared by Dr. Seaton, was included in my last Annual Report: a second such collection, relating to children born in 1873, was completed early in 1875, and Dr. Seaton's digest of it is now given in Appendix No. 2. It will there be seen that of the 826,508 children registered as born in England and Wales in the year 1873, all, up to a margin of less than 5 per cent. had, at the time of closing the return, been accounted for by the vaccination-officers; that, of the 95⅔ per cent. accounted for, 85⅕ were accounted for as vaccinated, and 9¾ as having died early and unvaccinated; while the small residue, not quite ⅔ per cent. on the whole number of births, included infants who had contracted smallpox before they could be vaccinated, infants who had been certified as insusceptible of vaccination, and (as by far the largest item) infants whose vaccination had for the time been postponed under medical certificate.

3. The maintenance of the public supply of vaccine lymph, and the arrangements under which candidates for appointment as public vaccinators obtain the authorised certificates of proficiency in vaccination required of them by the regulations of the Board, were in 1875 as usual superintended by the Board through this Department; and the vaccination-stations which are concerned with those special objects underwent their usual special inspection. Subjoined, in Appendix No. 3, I give the statistics of these branches of service; and here I need only mention that in 1875 the Department supplied vaccine lymph in answer to more than 10,000 applications.

II. In 1875, 27 local inquiries were made by inspectors of this Department with regard to particular facts of disease in particular places, or to conditions which were deemed likely to cause disease; and I subjoin, in Appendix No. 4., a list of these inquiries, with an abstract of the chief results of each as reported by the medical inspector. In 4 of the 27 cases (Nos. 14, 15, 21, 23) the matter of inquiry lay chiefly or wholly outside the province of the local sanitary authority; but in the other 23 cases, the inspectors' reports, so far as they go, exhibit the working of the Sanitary Acts under the 41 local authorities (25 urban and 16 rural) whose districts were visited. In England and Wales, however, the areas of separate jurisdiction for general sanitary purposes are 1557; that is to say, in addition to the 39 which are metropolitan, there are 928 urban and 590 rural jurisdictions: and the above inspections, extending to only 41 of this number, though they represent, as applied to the new Local Sanitary Administration, the inquiring function which was formerly exercised by the Privy Council under the Act of 1858 in matters concerning the Public Health, evidently do not constitute an amount of observation on which it would be possible for me to base any such general report under that Act with regard to the sanitary progress and requirements of the country as I can present with regard to vaccination.

Concerning two of the cases in which local inquiry was made,

the reports, which in both cases are by Dr. Buchanan, are subjoined in full. The one (Appendix No. 5.) relates to a considerable and very disappointing prevalence of enteric fever in the town of Croydon, where for many years great exertions have been made for sanitary improvement, and in regard of which it is therefore particularly important that the explanation of so unexpected a result should, if possible, be arrived at. The other (Appendix No. 6.) relates to a curious outbreak of scarlatina among certain persons—a private family and its guests, who had met on a festive occasion, and who, it seemed probable, might have got their infection in common from partaking of an infected article of food.

Places were also visited by medical inspectors on six occasions with reference to questions of hospital-accommodation for cases of infectious disease: chiefly in order to assist the Board in determining whether (under a provision of law which has since been repealed) it should declare particular hospitals to be for the purposes of the law within a "convenient distance" of particular sanitary districts, or whether its approval, required in other respects for the particular hospital-arrangements, should be given. On one of these occasions the question concerned the five small neighbouring urban districts of Drighlington, Birstal, Birkenshaw, Churwell, and Atherton; on another, the two neighbouring rural districts of Chester and Tarvin; on the others, singly, the respective rural districts of Darlington and Hexham, and the respective urban districts of Todmorden and Over.

III. In addition to the above proceedings, two general inquiries, of the sort by which the Board from time to time seeks to increase its own knowledge and efficiency with regard to particular sections of the large sphere of medical subject-matter in which it has to advise or direct, were, in 1875, begun in the Medical Department:—one, a more exact and systematic study of the conditions which determine the spread and intensity of scarlatina; the other, a study concerning the effluvium-nuisances which arise in connexion with various manufacturing and other branches of industry, and specially with regard to the effect upon health of each such industry, and to the degree in which the nuisance can be prevented.

1. The inquiry concerning scarlatina is in the hands of Dr. Buchanan, who, by way of introduction to it, has had to make careful examination of the mortuary statistics of the disease as presented in the Registrar-General's returns of the last 22 years. This examination has not hitherto suggested any clue which could advantageously be followed up by detailed local inquiries; and it seems probable that the progress of the investigation must mainly depend on opportunities which the Department may accidentally find, or which the friendly co-operation of local officers of health and of private medical practitioners may afford us, for studying in detail, and at the earliest possible moment, such outbreaks of scarlatina as shall appear exceptional in any of their circum-

stances, and particularly those where the outbreak may seem imputable to any other cause than contagion.

2. The inquiry concerning the branches of industry which tend to produce nuisance by their effluvia is in the hands of Dr. Ballard, who possesses very eminent qualifications for dealing with it successfully. Inspections in contribution to it have already been made by him on a large scale in and about the Metropolis and down the Thames, as also at several centres of industry in the Midland Black Country and in Lancashire, and at Plymouth and Devonport, Bristol, Southampton, and some other places: and the offensive industries, large and small, which he has investigated, are already not fewer than fifty. Extension of the inquiry is still necessary, especially in order that the practical conclusions arrived at, with regard to the degree in which any given effluvium-nuisance is preventable, may rest on a sufficiently large basis of facts; and I therefore, instead of now bringing before you any fragmentary statement from Dr. Ballard, propose that his whole treatment of the subject should come before you later in a supplement to the present Report.

IV. In respect of the cognizance which the Medical Department has to take of the progress of Foreign Epidemics I subjoin (Appendix No. 7.) a Memorandum by Mr. Netten Radcliffe on the modern history and more recent movements of Levantine Plague. I regret to observe that at the present time the infection of the disease is in Baghdad; for, being there, it may find considerable facilities for diffusing itself to other places; and though, in view of the experience of the last two centuries, we need not, I think, anticipate as probable, that, if plague should extend considerably in the Levant, it must therefore necessarily extend to any part of Western Europe, still, any wide Eastern diffusion of the disease, especially if to the seaports of Turkey or Egypt, could hardly fail to excite alarm in Western Europe, and at least to cause much derangement of traffic.

In my last Annual Report I mentioned that Mr. Radcliffe was at the time engaged in compiling an account of the movements of Asiatic Cholera, in relation to Europe for the last preceding ten years; and subsequently, in supplement to the Annual Report, I had the honour of submitting to you the elaborate compilation which Mr. Radcliffe with some months further work had then completed. Since the date of that supplementary report of last year, nothing in respect of cholera has occurred which seems to require present mention.

I am, sir,

Your obedient servant,

John Simon.

Medical Department, March 31, 1876.

APPENDIX.

No. 1.

List (alphabetically arranged) of 371 Unions inspected during the Year 1875, with reference to their Proceedings under the Vaccination Acts, 1867 and 1871, and an Account of the Awards made to the respective Public Vaccinators out of Moneys voted by Parliament for that Purpose.

Union.	No. of Vaccination Districts in Union.	No. of respective Vaccination Contractors recommended for Award.		Range of Awards in each Union.		Total Sum awarded in the Union.	Name of Inspector.
		1st Class Award.	2nd Class Award.	Minimum.	Maximum.		
				£ s. d.	£ s. d.	£ s. d.	
Aberayron	2	1	1	8 4 8	13 9 0	21 13 8	Dr. Airy.
Aberystwith	5	1	3	7 5 4	15 0 0	42 13 4	Do.
Alcester	5	1	—	—	—	3 11 0	„ Ballard.
Alderbury	5	4	—	4 7 0	24 18 0	41 19 0	„ Blaxall.
Amersham	7	2	1	6 9 4	10 10 0	23 19 4	„ Thorne.
Amesbury	2	1	1	5 17 0	6 0 0	11 17 0	„ Blaxall.
Anglesey	3	1	—	—	—	8 15 0	Do.
Asaph, St.	5	1	—	—	—	5 4 0	Do.
Ashford, East	6	3	—	2 0 0	7 0 0	11 15 0	„ Stevens.
Ashford, West	3	3	—	5 14 0	18 4 0	33 5 0	Do.
Ashton-under-Lyne	12	6	—	8 12 0	42 10 0	152 5 0	„ Beard.
Aston	7	3	—	8 11 0	88 1 0	160 3 0	Mr. Power.
Atcham	6	—	—	—	—	—	Dr. Blaxall.
Atherstone	2	—	—	—	—	—	Mr. Power.
Auckland	9	6	—	18 10 0	50 14 0	193 9 0	Do.
Axbridge	12	3	1	2 9 0	7 13 0	16 19 8	Dr. Blaxall.
Aylesbury	7	5	—	5 14 0	13 17 0	40 10 0	„ Thorne.
Aysgarth	3	1	—	—	—	2 18 0	Mr. Power.
Bala	1	—	—	—	—	—	Dr. Blaxall.
Banbury	7	3	2	3 0 8	7 8 0	23 12 0	„ Thorne.
Bangor and Beaumaris.	5	—	—	—	—	—	„ Blaxall.
Barnsley	6	4	—	2 12 0	66 4 0	111 8 0	„ Beard.
Barton-on-Irwell	5	4	—	9 12 0	44 14 0	90 5 0	Do.
Bath	5	3	1	2 8 0	45 6 0	60 9 0	„ Blaxall.
Battle	6	1	—	—	—	2 5 0	„ Stevens.
Beaminster	5	—	—	—	—	—	„ Blaxall.
Bedale	3	3	—	2 13 0	9 18 0	17 0 0	Mr. Power.
Bedminster	9	4	—	3 15 0	10 0 0	27 14 0	Dr. Blaxall.
Belford	2	—	2	2 8 0	3 6 0	5 14 0	Mr. Power.
Berwick	5	3	—	1 6 0	16 2 0	24 14 0	Do.
Bethnal Green	2	2	—	61 19 0	120 6 0	182 5 0	Dr. Stevens.
Bicester	7	1	1	3 16 0	5 15 0	9 11 0	„ Thorne.
Billericay	5	—	1	—	—	3 14 0	„ Airy.
Birmingham	1	1	—	—	—	275 14 0	„ Seaton.
Blackburn	10	6	—	23 10 0	39 5 0	185 1 0	„ Beard.
Blandford	4	—	1	—	—	3 16 0	„ Blaxall.
Blean	4	2	—	11 18 0	15 0 0	26 18 0	„ Stevens.
Blything	8	2	—	5 7 0	6 12 0	11 19 0	„ Airy.
Bolton	8	6	—	6 10 0	95 3 0	210 11 0	„ Beard.
Bosmere and Claydon	5	2	1	3 18 0	6 1 0	15 16 0	„ Airy.
Brackley	5	2	—	4 5 0	6 7 0	10 12 0	„ Thorne.
Bradford (Wilts)	3	—	1	—	—	1 18 0	„ Blaxall.
Bradford (Yorks.)	6	3	—	24 6 0	50 8 0	107 0 0	„ Beard.
Braintree	4	4	—	8 2 0	21 8 0	57 14 0	„ Airy.
Bramley	5	3	—	4 12 0	32 11 0	46 5 0	„ Beard.
Brecknock	3	2	—	10 18 0	12 1 0	22 19 0	„ Airy.
Brentford	9	2	2	7 3 4	18 1 0	43 17 8	„ Thorne.
Bridge	5	4	—	2 4 0	7 0 0	20 4 0	„ Stevens.
Bridgend and Cowbridge.	4	1	—	—	—	27 9 0	„ Airy.

App. No. 1.

Inspection of Public Vaccination.

Union.	No. of Vaccination Districts in Union.	No. of respective Vaccination Contractors recommended for Award.		Range of Awards in each Union.		Total Sum awarded in the Union.	Name of Inspector.
		1st Class Award.	2nd Class Award	Minimum.	Maximum.		
				£ s. d.	£ s. d.	£ s. d.	
Bridgewater	10	1	2	1 16 0	7 12 0	15 2 0	Dr. Blaxall.
Bridgnorth	3	2	—	6 18 0	11 19 0	18 17 0	Do.
Bridport	4	2	—	4 16 0	5 10 0	10 6 0	Do.
Brighton	2	1	1	19 6 8	37 2 0	56 8 8	„ Stevens.
Brixworth	6	2	1	3 4 0	5 12 0	12 2 8	„ Thorne.
Bromley	4	1	1	2 16 0	4 16 0	7 12 0	„ Stevens.
Buckingham	4	—	—	—	—	—	„ Thorne.
Builth	1	—	—	—	—	—	„ Airy.
Burnley	7	3	—	1 11 0	17 14 0	25 16 0	„ Beard.
Burton-on-Trent	8	1	—	—	—	21 7 0	„ Ballard.
Bury	6	4	—	19 2 0	32 17 0	109 6 0	„ Beard.
Calne	1	—	—	—	—	—	„ Blaxall.
Camberwell	5	5	—	3 11 0	39 18 0	117 9 0	„ Stevens.
Cambridge	1	—	—	—	—	—	Mr. Power.
Canterbury	1	1	—	—	—	20 15 0	Dr. Stevens.
Cardiff	6	3	1	2 8 0	56 17 0	113 6 8	„ Airy.
Cardigan	3	1	—	—	—	12 14 0	Do.
Carmarthen	8	2	1	2 8 8	14 19 0	30 16 8	Do.
Carnarvon	5	—	—	—	—	—	„ Blaxall.
Castle Ward	6	2	—	4 5 0	11 13 0	15 18 0	Mr. Power.
Caxton and Arrington	5	3	—	9 16 0	13 11 0	35 13 0	Do.
Cerne	4	1	1	0 12 8	5 15 0	6 7 8	Dr. Blaxall.
Chailey	4	1	—	—	—	9 9 0	„ Stevens.
Chard	7	1	—	—	—	10 12 0	„ Blaxall.
Cheadle	5	2	2	3 1 4	11 14 0	28 15 4	„ Ballard.
Chelmsford	10	6	1	2 7 4	14 7 0	57 4 4	„ Airy.
Chelsea	2	2	—	12 6 0	93 16 0	106 2 0	„ Stevens.
Chester-le-Street	2	2	—	46 5 0	77 6 0	123 11 0	Mr. Power.
Chesterton	7	2	—	12 19 0	13 13 0	26 12 0	Do.
Chichester	1	1	—	—	—	8 1 0	Dr. Stevens.
Chippenham	7	1	1	3 2 0	4 8 0	7 10 0	„ Blaxall.
Chipping Norton	4	1	2	2 10 0	11 8 0	24 7 0	„ Thorne.
Chorley	5	2	—	17 12 0	19 1 0	36 13 0	„ Beard.
Chorlton	11	3	1	2 15 4	47 16 0	88 18 4	Do.
Church Stretton	4	1	—	—	—	4 0 0	„ Blaxall.
Cleobury Mortimer	2	—	—	—	—	—	Do.
Clitheroe	5	1	—	—	—	4 8 0	„ Beard.
Clun	4	—	1	—	—	2 0 8	„ Blaxall.
Clutton	5	2	—	2 6 0	19 19 0	22 5 0	Do.
Colchester	1	1	—	—	—	39 11 0	„ Airy,
Conway	2	2	—	14 3 0	20 1 0	34 4 0	„ Blaxall.
Corwen	3	—	—	—	—	—	Do.
Cosford	6	3	—	5 17 0	12 5 0	25 5 0	„ Airy.
Cranbrook	6	3	—	1 18 0	8 0 0	17 4 0	„ Stevens.
Crickhowel	2	Under consideration.					„ Airy.
Cricklade and Wootton Bassett.	3	—	1	—	—	4 19 4	„ Blaxall.
Cuckfield	6	5	—	2 6 0	9 3 0	35 15 0	„ Stevens.
Darlington	5	1	—	—	—	57 3 0	Mr. Power.
Dartford	5	5	—	11 9 0	27 13 0	82 10 0	Dr. Stevens.
Daventry	6	1	1	2 17 4	8 4 0	11 1 4	„ Thorne.
Devizes	7	2	1	2 8 8	16 9 0	25 7 8	„ Blaxall.
Dewsbury	11	5	—	7 4 0	19 4 0	64 2 0	„ Beard.
Dolgelly	5	3	—	2 14 0	9 15 0	21 13 0	„ Blaxall.
Doncaster	7	3	—	4 5 0	15 3 0	24 6 0	„ Beard.
Dorchester	6	1	—	—	—	7 4 0	„ Blaxall.
Dover	4	1	1	3 15 4	6 3 0	9 18 4	„ Stevens.
Drayton	5	1	—	—	—	0 15 0	„ Blaxall.
Dulverton	3	—	1	—	—	0 14 0	Do.
Dunmow	6	—	—	—	—	—	„ Airy.
Durham	5	2	—	10 4 0	44 15 0	54 19 0	Mr. Power.
Easington	5	3	—	15 9 0	30 10 0	70 17 0	Do.
Easingwold	4	2	1	2 4 0	5 19 0	12 1 0	Do.
East Grinstead	5	3	1	5 17 0	9 1 4	30 10 4	Dr. Stevens.
East Preston	4	—	—	—	—	—	Do.
Eastbourne	4	4	—	2 17 0	26 6 0	36 15 0	Do.
Eastry	7	5	—	4 9 0	10 7 0	34 12 0	Do.
Eccleshall Bierlow	3	1	—	—	—	116 19 0	„ Beard.
Edmonton	13	7	1	0 10 8	33 2 0	86 11 8	„ Thorne.
Elham	5	1	—	—	—	5 0 0	„ Stevens.
Ellesmere	7	1	—	—	—	2 7 0	„ Blaxall.

Union.	No. of Vaccination Districts in Union.	No. of respective Vaccination Contractors recommended for Award.		Range of Award in each Union.		Total Sum awarded in the Union.	Name of Inspector.
		1st Class Award.	2nd Class Award.	Minimum.	Maximum.		
				£ s. d.	£ s. d.	£ s. d.	
Ely	7	2	—	11 7 0	13 19 0	25 6 0	Mr. Power.
Epping	10	—	—	—	—	—	Dr. Airy.
Eton	8	2	—	8 11 0	11 11 0	20 2 0	„ Thorne.
Faversham	4	3	—	12 10 0	13 3 0	38 13 0	„ Stevens.
Festiniog	3	—	—	—	—	—	„ Blaxall.
Foleshill	5	1	—	—	—	13 4 0	Mr. Power.
Forden	4	1	—	—	—	8 6 0	Dr. Blaxall.
Frome	5	—	—	—	—	—	Do.
Fylde, The	5	—	—	5 12 0	15 13 0	39 3 0	„ Beard.
Garstang	3	2	—	7 2 0	11 4 0	18 6 0	Do.
Gateshead	6	—	—	—	—	—	Mr. Power.
George St., East	1	1	—	—	—	72 17 0	Dr. Stevens.
Goole	5	Under consideration.				—	„ Beard.
Gower	2	1	—	—	—	9 13 0	„ Airy.
Gravesend and Milton	1	1	—	—	—	16 1 0	„ Stevens.
Guisborough	6	1	—	—	—	9 10 0	Mr. Power.
Hackney	4	4	—	9 3 0	30 8 0	77 17 0	Dr. Stevens.
Hailsham	6	3	—	3 16 0	7 4 0	15 13 0	„ Do.
Halifax	9	5	—	13 12 0	27 10 0	111 10 0	„ Beard.
Halstead	5	1	—	—	—	3 5 0	„ Airy.
Hardingstone	3	2	—	6 10 0	9 19 0	16 9 0	„ Thorne.
Hartismere	5	—	—	—	—	—	„ Airy.
Hartlepool	3	2	1	1 15 4	52 14 0	99 15 4	Mr. Power.
Haslingden	6	4	—	5 5 0	26 8 0	66 18 0	Dr. Beard.
Hastings	2	2	—	1 16 0	32 0 0	33 16 0	„ Stevens.
Harverfordwest	4	1	—	—	—	12 16 0	„ Airy.
Hawarden	3	2	—	18 15 0	19 5 0	38 0 0	„ Blaxall.
Hay	3	2	—	6 14 0	9 10 0	16 4 0	„ Airy.
Headington	2	—	1	—	—	27 3 4	„ Thorne.
Helmsley Blackmoor	2	2	—	4 7 0	4 16 0	9 3 0	Mr. Power.
Hemsworth	4	3	—	1 11 0	9 0 0	17 18 0	Dr. Beard.
Hendon	7	2	—	3 19 0	12 15 0	16 14 0	„ Thorne.
Henley	6	2	—	8 19 0	9 16 0	18 15 0	Do.
Highworth and Swindon.	4	—	—	—	—	—	„ Blaxall.
Holbeck	1	—	—	—	—	—	„ Beard.
Hollingbourne	6	3	—	3 2 0	8 14 0	19 7 0	„ Stevens.
Holyhead	3	—	—	—	—	—	„ Blaxall.
Holywell	5	2	—	25 8 0	28 2 0	53 10 0	Do.
Hoo	1	—	—	—	—	—	„ Stevens.
Horsham	6	4	1	1 3 4	15 1 0	33 12 4	Do.
Houghton-le-Spring	4	3	—	11 13 0	22 4 0	49 13 0	Mr. Power.
Hoxne	8	4	—	1 11 0	8 9 0	19 18 0	Dr. Airy.
Huddersfield	16	12	—	8 0 0	38 16 0	225 8 0	„ Beard.
Hunslet	3	2	—	2 13 0	9 9 0	12 2 0	Do.
Ipswich	1	1	—	—	—	76 6 0	„ Airy.
Islington	4	4	—	37 14 0	50 6 0	171 16 0	„ Stevens.
Kettering	4	2	—	11 7 0	17 17 0	29 4 0	Dr. Thorne.
Keynsham	1	1	—	—	—	63 2 0	„ Blaxall.
Kirkby Moorside	1	1	—	—	—	9 0 0	Mr. Power.
Knaresborough	3	—	—	—	—	—	Dr. Beard.
Knighton	4	—	—	—	—	—	„ Airy.
Lambeth	5	5	—	15 14 0	81 3 0	236 16 0	„ Stevens.
Lampeter	2	—	2	2 1 4	5 1 4	7 2 8	„ Airy.
Lancaster	5	—	—	—	—	—	„ Beard.
Lanchester	4	—	—	—	—	—	Mr. Power.
Langport	6	—	—	—	—	—	Dr. Blaxall.
Leeds	7	5	—	2 4 0	112 1 0	307 15 0	„ Seaton.
Leek	5	1	—	—	—	8 0 0	„ Ballard.
Leigh	3	2	—	21 15 0	28 19 0	50 14 0	„ Beard.
Lewes	1	1	—	—	—	10 11 0	„ Stevens.
Lewisham	5	5	—	6 11 0	19 12 0	72 7 0	Do.
Lexden and Winstree	9	3	2	3 1 0	9 16 0	33 3 4	„ Airy.
Leyburn	6	1	—	—	—	1 16 0	Mr. Power.
Lichfield	6	3	—	3 12 0	29 2 0	42 11 0	Dr. Ballard.
Linton	3	1	—	—	—	12 13 0	Mr. Power.
Liverpool	3	3	—	100 8 0	210 0 0	486 7 0	Dr. Seaton.
Llandilo Faur	4	2	—	15 14 0	24 1 0	39 15 0	„ Airy.

App. No. 1.

Inspection of Public Vaccination.

Union.	No. of Vaccination Districts in Unions.	No. of respective Vaccination Contractors recommended for Award.		Range of Award in each Union.		Total Sum awarded in the Union.	Name of Inspector.
		1st Class Award.	2nd Class Award.	Minimum.	Maximum.		
				£ s. d.	£ s. d.	£ s. d.	
Llandovery	2	—	—	—	—	—	Dr. Airy.
Llanelly	2	—	—	—	—	—	Do.
Llanfyllin	5	—	—	—	—	—	„ Blaxall.
Llanrwst	2	—	—	—	—	—	Do.
London, city of	2	2	—	27 13 0	32 12 0	60 5 0	„ Stevens.
Ludlow	5	—	1	—	—	7 8 0	„ Blaxall.
Lunesdale	5	1	—	—	—	3 3 0	„ Beard.
Machynlleth	5	—	—	—	—	—	„ Blaxall.
Madeley	4	1	—	—	—	41 19 0	Do.
Maidstone	5	4	—	5 19 0	51 7 0	74 9 0	Dr. Stevens.
Maldon	7	1	1	6 5 4	6 14 0	12 19 4	Dr. Airy.
Malling	4	3	—	10 6 0	15 6 0	37 3 0	„ Stevens.
Malmesbury	4	1	1	5 10 8	9 2 0	14 12 8	„ Blaxall.
Malton	6	2	1	3 0 0	7 18 0	17 5 0	Mr. Power.
Manchester	3	3	—	109 2 0	131 17 0	367 7 0	Dr. Seaton.
Marlborough	2	1	—	—	—	5 6 0	„ Blaxall.
Marylebone	1	1	—	—	—	149 18 0	„ Stevens.
Medway	3	2	—	26 13 0	43 1 0	69 14 0	Do.
Melksham	2	1	—	—	—	12 2 0	„ Blaxall.
Mere	2	2	—	7 19 0	9 15 0	17 14 0	Do.
Meriden	4	3	1	2 1 4	9 15 0	19 11 4	Mr. Power.
Merthyr Tydfil	9	7	—	7 6 0	76 3 0	348 15 0	Dr. Airy.
Midhurst	5	4	—	2 11 0	11 18 0	23 3 0	„ Stevens.
Mile End	2	2	—	36 19 0	57 0 0	93 19 0	Do.
Milton	2	2	—	14 9 0	34 16 0	49 5 0	Do.
Morpeth	8	—	—	—	—	—	Mr. Power.
Mutford and Lothingland.	3	—	2	13 13 4	20 4 8	33 18 0	Dr. Airy.
Narberth	4	—	—	—	—	—	„ Airy.
Neath	8	4	—	12 13 0	64 13 0	121 12 0	Do.
Neot's, St.	6	2	—	5 17 0	13 0 0	18 17 0	„ Stevens.
Newcastle-in-Emlyn	3	1	—	—	—	19 6 0	„ Airy.
Newcastle-under-Lyme.	3	1	—	—	—	41 4 0	„ Ballard.
Newcastle-on-Tyne	3	5	—	26 13 0	54 3 0	200 11 0	„ Seaton.
Newhaven	5	2	—	1 14 0	8 19 0	10 13 0	„ Stevens.
Newmarket	9	1	1	4 16 8	13 12 0	18 8 8	Mr. Power.
Newport (Salop)	4	1	—	—	—	4 17 0	Dr. Blaxall.
Newport Pagnell	11	1	—	—	—	4 10 0	„ Thorne.
Newtown and Llanidloes.	4	—	—	—	—	—	„ Blaxall.
Northallerton	4	1	—	—	—	1 16 0	Mr. Power.
Northampton	4	1	—	—	—	12 9 0	Dr. Thorne.
North Aylesford	2	2	—	23 2 0	23 7 0	46 9 0	„ Stevens.
North Bierley	12	8	—	3 2 0	30 17 0	141 19 0	„ Beard.
North Witchford	4	2	—	5 2 0	7 14 0	12 16 0	Mr. Power.
Nuneaton	2	1	—	—	—	9 9 0	Do.
Oldham	6	3	—	13 1 0	62 8 0	98 19 0	Dr. Beard.
Ongar	6	—	—	—	—	—	„ Airy.
Ormskirk	6	1	2	2 18 8	4 14 0	10 13 4	„ Beard.
Orsett	6	3	—	2 10 0	11 17 0	22 5 0	„ Airy.
Oswestry	5	1	1	1 17 4	16 2 0	17 19 4	„ Blaxall.
Oundle	4	2	—	7 6 0	12 19 0	20 5 0	„ Thorne.
Ouseburn, Great	6	5	—	2 8 0	8 16 0	19 11 0	„ Beard,
Oxford	1	1	—	—	—	42 17 0	„ Thorne.
Paddington	2	2	—	33 6 0	35 7 0	68 13 0	„ Stevens.
Pancras, St.	1	1	—	—	—	258 14 0	Do.
Pateley Bridge	3	1	—	—	—	15 10 0	„ Beard.
Pembroke	6	4	—	7 4 0	19 8 0	44 14 0	„ Airy.
Penistone	3	2	—	11 1 0	17 16 0	28 17 0	„ Beard.
Penkridge	4	1	—	—	—	30 3 0	„ Ballard.
Peterborough	7	5	1	0 18 8	44 1 0	84 14 8	„ Thorne.
Petworth	4	4	—	2 13 0	10 8 0	19 8 0	„ Stevens.
Pewsey	4	3	—	8 5 0	10 13 0	28 14 0	„ Blaxall.
Pickering	3	1	—	—	—	10 7 0	Mr. Power.
Plomesgate	6	2	1	4 12 0	5 2 8	14 14 8	Dr. Airy.
Pontardawe	2	—	—	—	—	—	Do.
Pontefract	7	3	1	3 4 8	38 15 0	62 9 8	„ Beard.
Pontypridd	8	4	—	10 6 0	35 6 0	96 8 0	„ Airy.
Poole	4	2	1	3 15 0	11 16 0	19 9 0	„ Blaxall.

Union.	No. of Vaccination Districts in Union.	No. of respective Vaccination Contractors recommended for Awards.		Range of Award in each Union.		Total Sum awarded in the Union.	Name of Inspector.
		1st Class Award.	2nd Class Award.	Minimum.	Maximum.		
				£ s. d.	£ s. d.	£ s. d.	
Potterspury	4	—	—	—	—	—	Dr. Thorne.
Prescot	8	4	—	6 17 0	53 15 0	101 14 0	„ Beard.
Presteigne	1	1	—	—	—	8 8 0	„ Airy.
Preston	8	4	—	18 0 0	28 13 0	90 5 0	„ Beard.
Prestwich	6	2	—	6 4 0	85 12 0	91 16 0	Do.
Pwllheli	5	2	—	6 9 0	10 2 0	16 11 0	„ Blaxall.
Reeth	2	—	—	—	—	—	Mr. Power.
Rhayader	2	—	—	—	—	—	Dr. Airy.
Richmond (Yorks)	5	2	—	4 5 0	5 8 0	9 13 0	Mr. Power.
Ripon	4	1	—	—	—	5 5 0	Dr. Beard.
Rochdale	7	5	—	4 14 0	49 6 0	79 14 0	Do.
Rochford	5	1	—	—	—	13 18 0	„ Airy.
Romford	7	5	—	3 1 0	31 7 0	88 2 0	Do.
Romney Marsh	3	2	—	0 18 0	6 12 0	7 10 0	„ Stevens
Rotherham	8	4	—	3 0 0	64 14 0	122 0 0	„ Beard.
Rugby	8	—	—	—	—	—	Mr. Power.
Ruthin	3	1	—	—	—	11 18 0	Dr. Blaxall.
Rye	3	2	—	5 1 0	13 7 0	18 8 0	„ Stevens.
Saddleworth	1	—	—	—	—	—	„ Beard.
Saffron Walden	8	4	—	2 0 0	9 7 0	21 5 0	„ Airy.
Salford	3	2	—	108 6 0	126 17 0	235 3 0	„ Beard.
Samford	5	1	—	—	—	11 3 0	„ Airy.
Scarborough	5	2	—	8 1 0	29 2 0	37 3 0	Mr. Power.
Sedbergh	3	1	—	—	—	2 1 0	Dr. Beard.
Sedgfield	4	—	—	—	—	—	Mr. Power.
Seisdon	4	3	—	7 0 0	9 8 0	25 3 0	Dr. Ballard.
Selby	5	Under consideration.				—	„ Beard.
Settle	8	2	—	0 17 0	3 12 0	4 9 0	Do.
Sevenoaks	6	2	—	4 2 0	7 13 0	11 15 0	„ Stevens.
Shaftesbury	3	—	—	—	—	—	„ Blaxall.
Sheppey	2	2	—	6 0 0	25 2 0	31 2 0	„ Stevens.
Shepton Mallet	4	1	—	—	—	2 17 0	„ Blaxall.
Sherborne	4	—	—	—	—	—	Do.
Shifnal	4	1	—	—	—	4 14 0	Do.
Skipton	8	—	—	—	—	—	„ Beard.
Solihull	4	2	—	5 7 0	5 10 0	10 17 0	Mr. Power.
Southam	4	4	—	3 17 0	8 11 0	24 13 0	Do.
South Shields	3	2	—	51 2 0	86 10 0	137 12 0	Do.
Stafford	4	3	—	4 15 0	29 13 0	48 14 0	Dr. Ballard.
Steyning	5	2	1	2 5 4	10 14 0	18 9 4	„ Stevens.
Stockton	7	2	—	28 9 0	48 1 0	76 10 0	Mr. Power.
Stokesley	3	—	—	—	—	—	Do.
Stoke-on-Trent	5	4	1	3 19 4	122 9 0	263 3 4	Dr. Ballard.
Stone	4	2	—	8 6 0	15 9 0	23 15 0	Do.
Stow	8	4	—	1 10 0	7 9 0	18 7 0	„ Airy.
Stratford	7	2	—	7 18 0	18 5 0	26 3 0	„ Ballard.
Sturminster	4	1	—	—	—	8 14 0	„ Blaxall.
Sudbury	7	3	—	5 2 0	18 1 0	31 7 0	„ Airy.
Sunderland	5	3	—	22 10 0	85 11 0	181 16 0	Mr. Power.
Swansea	3	2	—	74 11 0	137 3 0	211 14 0	Dr. Airy.
Tadcaster	4	1	—	—	—	3 17 0	„ Beard.
Tamworth	5	—	—	—	—	—	„ Ballard.
Taunton	7	4	—	2 2 0	7 13 0	21 18 0	„ Blaxall.
Teesdale	7	2	—	8 8 0	10 4 0	18 12 0	Mr. Power.
Tendring	11	—	1	—	—	6 13 4	Dr. Airy.
Tenterden	6	4	—	1 10 0	8 11 0	18 18 0	„ Stevens.
Thakeham	2	2	—	10 6 0	12 7 0	22 13 0	Do.
Thame	6	2	—	8 12 0	16 3 0	24 15 0	„ Thorne.
Thanet, Isle of	4	1	—	—	—	10 14 0	„ Stevens.
Thirsk	5	4	—	1 4 0	5 16 0	11 8 0	Mr. Power.
Thorne	6	1	—	—	—	4 2 0	Dr. Beard.
Thrapston	5	—	—	—	—	—	„ Thorne.
Ticehurst	8	5	—	1 3 0	7 5 0	23 19 0	„ Stevens.
Tisbury	3	1	—	—	—	6 0 0	„ Blaxall.
Todmorden	2	—	—	—	—	—	„ Beard.
Tonbridge	6	4	—	6 5 0	32 4 0	76 5 0	„ Stevens.
Towcester	4	1	—	—	—	13 18 0	„ Thorne.
Toxteth Park	2	1	—	—	—	105 19 0	„ Beard.
Tregaron	2	—	2	4 16 0	6 8 8	11 4 8	„ Airy.
Tynemouth	7	4	—	16 0 0	36 3 0	113 11 0	Mr. Power.

App. No. 1.

Inspection of Public Vaccination.

Union.	No. of Vaccination Districts in Union.	No. of respective Vaccination Contractors recommended for Award.		Range of Award in each Union.		Total Sum awarded in the Union.	Name of Inspector.
		1st Class Award.	2nd Class Award.	Minimum.	Maximum.		
				£ s. d.	£ s. d.	£ s. d.	
Uckfield - - -	6	4	—	8 14 0	13 13 0	46 6 0	Dr. Stevens.
Uttoxeter - - -	5	—	—	—	—	—	„ Ballard.
Uxbridge - - -	7	6	—	3 2 0	17 3 0	49 5 0	„ Thorne.
Wakefield - -	6	4	—	3 7 0	32 12 0	69 17 0	„ Beard.
Walsall - - -	4	4	—	13 10 0	105 19 0	197 10 0	„ Ballard.
Wandsworth and Clapham.	8	5	—	2 12 0	83 11 0	198 0 0	„ Stevens.
Wangford - - -	2	1	—	—	—	11 5 0	„ Airy.
Wareham and Purbeck.	7	1	—	—	—	5 1 0	„ Blaxall.
Warminster - -	5	2	—	5 6 0	6 16 0	12 2 0	Do.
Warrington - -	3	3	—	7 13 0	69 4 0	108 14 0	„ Beard.
Warwick - - -	3	—	—	—	—	—	Mr. Power.
Weardale - - -	5	—	—	—	—	—	Do.
Wellingborough -	4	1	—	—	—	10 18 0	Dr. Thorn
Wellington (Salop) -	3	—	1	—	—	31 12 8	„ Blaxal
Wellington (Som.) -	6	—	—	—	—	—	Do.
Wells - - -	4	1	—	—	—	9 11 0	Do.
Wem - - - -	4	2	—	1 17 0	7 0 0	8 17 0	Do.
Westbourne - -	3	2	—	5 15 0	7 8 0	13 3 0	„ Stevens.
West Bromwich -	5	2	—	58 18 0	61 12 0	120 10 0	„ Ballard.
Westbury and Whorwellsdown.	4	2	—	2 4 0	2 7 0	4 11 0	„ Blaxall.
West Derby - -	6	4	—	3 17 0	177 10 0	349 10 0	„ Beard.
West Firle - -	3	2	—	1 6 0	1 14 0	3 0 0	„ Stevens.
West Ham - -	9	7	1	7 17 0	76 7 0	259 6 4	„ Airy.
West Hampnett -	5	2	1	2 10 8	13 5 0	21 12 8	„ Stevens.
Wetherby - -	6	3	—	3 3 0	3 15 0	10 11 0	„ Beard.
Weymouth - -	6	3	—	5 1 0	15 11 0	29 12 0	„ Blaxall.
Wharfedale - -	3	1	—	—	—	12 8 0	„ Beard.
Whitby - - -	4	1	1	6 2 0	8 7 0	14 9 0	Mr. Power.
Whitchurch (Salop)	4	3	—	1 11 0	9 17 0	18 19 0	Dr. Blaxall.
Whittlesey - -	2	1	—	—	—	10 11 0	Mr. Power.
Wigan - - -	8	2	—	30 3 0	54 15 0	84 18 0	Dr. Beard.
Williton - - -	7	1	—	—	—	5 9 0	„ Blaxall.
Wilton - - -	4	1	—	—	—	6 10 0	Do.
Wimborne and Cranborne.	4	2	—	9 8 0	10 4 0	19 12 0	Do.
Wincanton - -	6	2	1	3 10 0	8 18 0	16 7 0	Do.
Winslow - - -	3	1	—	—	—	6 10 0	Dr. Thorne.
Wisbeach - - -	14	5	—	0 15 0	12 6 0	42 5 0	Mr. Power.
Witham - - -	3	1	—	—	—	13 4 0	Dr. Airy.
Witney - - -	5	2	—	10 17 0	16 6 0	27 3 0	„ Thorne.
Wolstanton and Burslem.	3	2	—	45 3 9	59 1 0	104 4 0	„ Ballard.
Wolverhampton -	5	4	—	51 0 0	77 12 0	234 18 0	Do.
Woodbridge - -	4	2	1	3 18 0	11 3 0	23 16 4	„ Airy.
Woodstock - -	5	2	1	3 18 0	10 0 0	20 13 0	„ Thorne.
Woolwich - - -	3	3	—	16 8 0	62 16 0	136 16 0	„ Stevens.
Wortley - - -	3	2	—	9 10 0	13 4 0	22 14 0	„ Beard.
Wrexham - - -	5	1	—	—	—	67 6 0	„ Blaxall.
Wycombe - - -	12	4	—	2 3 0	13 0 0	21 7 0	„ Thorne.
Yeovil - - -	7	3	1	3 1 0	7 7 0	23 9 0	„ Blaxall.
Total -	1,782	730	78	—	—	15,696 19 8	

Supplementary List of Awards made in 1875 to Public Vaccinators in Unions which were inspected in 1874.

				£ s. d.	£ s. d.	£ s. d.	
Altrincham - -	6	4	—	8 9 0	22 9 0	60 13 0	Dr. Beard.
Brampton - - -	1	1	—	—	—	18 1 0	„ Airy.
Total -	7	5	—	—	—	78 14 0	

No. 2.

DIGEST, by DR. SEATON, of the VACCINATION OFFICERS' RETURNS (so far as received to January 31st, 1875) with regard to children whose births were registered in 1873.

The following return, which is the second annual return under the Vaccination Act, 1871, shows the continued successful working of that Act. Of 826,508 births returned to the Board by the several Vaccination Officers in England and Wales as registered during the year 1873,* the number which at the time the return was made had been registered as successfully vaccinated was 704,666 (being 85·2 per cent. of the whole) and the number registered as having died before they could be vaccinated was 80,512 (or 9·7 per cent of the whole). Of the remaining 41,330 children, 942 (or 0·113 per cent. of the whole) had been registered as insusceptible of successful vaccination†; 86 (or 0·01 per cent.) as having contracted small-pox before they could be vaccinated; 4,264 (or 0·51 per cent.) as having their vaccination postponed by medical certificate; leaving 36,038 (or 4·3 per cent.) as "removed," "not to be traced," or otherwise unaccounted for.‡ If from the 826,508 births returned by these officers deduction of the deaths without vaccination be first made, it appears that of the surviving 745,996 children, there were registered, at the time of the return, 94·45 per cent. as successfully vaccinated; 0·14 per cent. as either insusceptible of vaccination or as having had small-pox; and 0·57 per cent. as under medical certificate of postponement; leaving 4·8 per cent. as at that time still to account for.

Of the 36,038 registered births entered in the last column of the return as remaining unaccounted for, the very large majority were children who could not be found by the vaccination officers, usually because of the removal of the parents from the place of birth, but sometimes because of the birth itself having been registered (as is not uncommon in the case of illegitimate children) under a false name or false address. In many districts the amount of removals without vaccination which was returned was larger, and in some considerably larger, than it should have been, on account of *undue delay* on the part of the vaccination officer in instituting the inquiries which the Board's "Instructions to Vaccination Officers" direct. The remaining cases in the column (with the exception of a certain number in which vaccination had really been performed successfully, but which could not be registered as vaccinated on account of the legal certificate of vaccination not having been received by the vaccination officer) were cases which at

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* From the Union of Tendring (914 births); from the Heworth and Whickham subdistricts of the Gateshead union (958 births); from the Moreton-on-the-Marsh subdistrict of the Shipton-on-Stour union (179 births), from the Sedbergh subdistrict of the Sedbergh union (57 births), no returns were received. The return from the Llansaintfraid subdistrict of the Llanfyllin union embraced only the latter half of the year, giving no information as to the 130 births registered during the first half.

† Of these, probably not one was *really* insusceptible. The cases included under this heading are children, who, being certified as having been three times unsuccessfully vaccinated, are no longer subject to the compulsory provisions of the law. It is satisfactory to note that the proportion of these cases on the present return is not much more than half what it was on the return for 1872.

‡ Correspondence in 1875 shows that many of these cases have since been accounted for.

the time of the return remained unvaccinated in the union or district of birth. Local imperfections in administrative machinery, as, *e.g.*, the employment of an insufficient number of vaccination officers or the employment of persons whose time was taken up too much by other work, want of activity or intelligence in the discharge of their duties on the part of the officers themselves, and want of due supervision of the officers by the Guardians were the main causes of this default, where it occurred. In four unions—Banbury, Dewsbury, Keighley, Leek—there was actual refusal on the part of the Guardians to give effect to the compulsory provisions of the law. The number of cases in which non-vaccination was due to direct refusal on the part of parents to comply with the law when required to do so, constitutes an utterly insignificant proportion of the cases entered in this column.

The proportion of cases not finally accounted for in England and Wales in 1873 was (including postponed cases) 4·8 per cent. of the registered births,—an improvement of 0·3 per cent. on the return for 1872. The proportion unaccounted for in the Metropolis (which on the present return is 8·7 per cent. of registered births, having in the return for 1872 been 8·8 per cent.) considerably exceeds, as it did in that year, the proportion in the kingdom at large. There are doubtless, as stated in last year's summary, special difficulties in dealing with the Metropolitan population; and these difficulties so differ in the several Metropolitan Unions that nothing like uniformity among them is to be looked for. But the differences shown in the returns to exist between the several Unions are much too great to be wholly accounted for in that way; and there can be no doubt that in many of the Metropolitan Unions there is great administrative defect, either by employment of an insufficient staff or by want of proper supervision.

When the Metropolitan Unions are deducted from the rest of the Kingdom the proportion of cases not finally accounted for is reduced to 4·2 per cent. In 40 of the counties in England and Wales the present return shows a smaller per-centage not finally accounted for than did the previous one; the improvement being proportionately most exhibited in Wales. On the return for 1872, there were twelve counties in England and seven in Wales in which the proportion of cases not finally accounted for amounted to, or exceeded, 5 per cent. of the registered births. On the present return there are but seven counties in England and three in Wales in which the proportion is so considerable as this; and in every one even of these ten counties, except Radnorshire, there is an improvement on the previous return.

In four counties, and in four only, is the proportion of cases not finally accounted for notably larger than on the return for 1872. In Worcestershire, where the proportion in 1872 was 3·3 per cent., it is on the present return 4·3 per cent., solely on account of a bad return from the union of Worcester; in the North Riding, where the proportion in 1872 was 3·8 per cent., it is on the present return 4·5 per cent., on account of a bad return from Guisborough; in the West Riding, where it was 4·4 per cent. in 1872, it is 6·6 per cent. on the present return, the difference in this case being much more than accounted for by the two unions—which have since become so notorious—of Dewsbury and Keighley, in which the Guardians refused to execute the law. Of 5,538 births registered in the Dewsbury union in 1873, no fewer than 1,735 are unaccounted for on this return, and of 1,931 births in Keighley no fewer than 788—making in the two unions 2,523 cases unaccounted for out of 7,269 births, or 34 per cent. The births in the remainder of the Riding were 66,988, of which all but 2,425, or 3·6 per cent., are finally accounted for. Apart then from those two unions, the present

return for the West Riding shows a considerably smaller, and not a larger, proportion of cases unaccounted for than did the return of 1872. The falling off in Radnorshire was entirely due to a bad return from Knighton.

In the summary for 1872, thirty-nine of the extra-Metropolitan Unions were singled out for unfavourable comment on account of the exceptionally large proportion of cases unaccounted for on their returns. It is to a certain extent satisfactory that only twelve of these should call for similar comment on the present return. These are Blandford, Cheltenham, Ashby-de-la-Zouch, Lincoln, Brentford, Pontypool, Banbury, Southampton, Burton-on-Trent, Leek, Newtown and Llanidloes, and Knighton; to which, however, have now to be added five Unions concerning which the previous return had given no special cause of complaint, viz., Hendon, Worcester, Guisborough, Dewsbury, Keighley. The returns from these seventeen unions, as compared with the rest of extra-Metropolitan England, give the following results :—

——	Births.	Cases unaccounted for.	Per-centage.
Seventeen unions as above -	27,560	5,938	21
Remainder of extra-Metropolitan England - -	680,332	23,930	3·5

Thus more than a fifth part of the cases unaccounted for in extra-Metropolitan England were from these seventeen unions. The danger, however, which is entailed by the indifference, neglect, or opposition of a few local authorities cannot, unfortunately, be limited to the localities themselves, but extends more or less over the kingdom.

The marked, though slight, improvement which this return shows over that for 1872 is the more satisfactory that during 1873 "the natural stimulus of Vaccination"—the SMALL-POX was comparatively absent from the country. In 1872 the recent epidemic of that disease was still raging, the registered deaths from it in that year being 19,094. In 1873 the deaths from small-pox were but 2,364. In my Report on that epidemic, which was published in the last Annual Report of the Medical Officer, I traced (p. 77) the effect of the system established by the Vaccination Laws, 1867 and 1871, in reducing the small-pox mortality in that portion of the population whose age brought it within their influence—the proportionate rate of small-pox mortality under five years of age to the total small-pox mortality in England and Wales having then already been reduced from 55 per cent. (which was its former rate) to 33½ per cent. in 1871, and to 30 per cent. in 1872. The Registrar-General's Abstracts for 1873, which have been published since my Report was made, show, as was anticipated, a still further reduction in that proportion : of the 2,364 small-pox deaths in England and Wales in that year, only 587 were in children under five years of age, or less than 25 per cent.

App. No. 2.

Digest of Vaccination Returns.

RETURNS, 1873.

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.	Percentage of Children not finally accounted for, including Cases postponed.
ENGLAND AND WALES.	826,508	704,666	942	86	80,512	4,264	36,038	4·8
Do., excluding Metropolitan Unions.	707,852	607,892	691	82	69,319	3,510	26,358	4·2
The Metropolitan Unions.	118,656	96,774	251	4	11,193	754	9,680	8·7
Counties.								
Bedford - -	5,223	4,557	—	—	556	31	79	2·1
Berks - -	7,231	6,458	10	—	567	54	142	2·7
Bucks - -	5,233	4,619	9	—	463	26	116	2·7
Cambridge -	6,443	5,629	3	—	616	31	164	3·08
Chester - -	18,981	16,474	12	1	1,828	83	583	3·5
Cornwall - -	10,974	9,460	14	5	1,107	92	296	3·5
Cumberland -	7,962	7,022	6	7	776	25	126	1·8
Derby - -	12,485	10,769	20	—	1,386	51	259	2·4
Devon - -	18,097	15,915	13	1	1,501	140	527	3·6
Dorset - -	5,503	4,846	1	—	381	36	239	4·9
Durham - -	35,574	29,894	34	6	4,053	159	1,428	4·1
Essex - -	14,379	12,731	11	1	1,208	63	365	2·9
Gloucester -	16,066	13,840	12	1	1,451	36	726	4·7
Hereford - -	3,334	2,899	3	—	271	21	140	4·8
Herts - -	7,128	6,408	9	1	569	19	122	1·9
Hunts - -	1,849	1,677	—	—	145	9	18	1·4
Kent (extra metropolitan).	20,520	18,313	25	1	1,650	85	446	2·6
Lancaster -	115,350	99,417	65	4	11,754	324	3,786	3·5
Leicester - -	10,444	8,724	9	—	1,221	41	449	4·6
Lincoln - -	13,839	11,589	11	—	1,494	118	627	5·3
Middlesex (extra metropolitan).	8,483	6,711	41	4	701	34	992	12·0
Monmouth -	8,688	7,322	6	—	827	45	488	6·6
Norfolk - -	13,068	11,306	13	2	1,316	63	368	3·2
Northampton -	9,048	7,724	9	1	957	46	311	3·9
Northumberland -	15,663	13,495	33	1	1,655	74	405	3·0
Nottingham -	13,495	11,168	7	1	1,514	129	676	5·9
Oxford - -	5,741	4,809	6	—	558	36	332	6·4
Rutland - -	707	630	1	—	65	3	8	1·5
Shropshire -	8,422	7,457	10	—	721	26	208	2·7
Somerset - -	14,780	13,019	23	—	1,218	77	443	3·5
Southampton -	16,608	14,565	31	2	1,302	152	556	4·3
Stafford - -	31,930	27,377	22	4	3,177	89	1,261	4·2
Suffolk - -	11,056	9,710	4	—	942	56	344	3·6
Surrey (extra metropolitan).	12,007	10,265	7	1	920	170	644	6·7
Sussex - -	12,972	11,327	21	—	1,027	175	422	4·6
Warwick - -	23,667	20,488	23	8	2,485	56	607	2·8
Westmoreland -	1,981	1,802	7	—	155	6	11	·8
Wilts - -	7,696	6,933	4	—	571	50	138	2·4
Worcester -	18,878	16,104	25	7	1,930	108	704	4·3
York, E.R. -	11,118	9,487	34	—	1,165	53	379	3·8
York, N.R. -	8,440	7,141	9	2	905	75	308	4·5
York, W.R. -	74,257	60,912	57	9	8,331	203	4,745	6·6

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.	Percentage of Children not finally accounted for, including Cases postponed.
WALES.								
Anglesey - -	906	789	—	—	74	8	35	4·7
Brecknock -	1,810	1,562	—	—	162	35	51	4·7
Cardigan - -	2,259	1,875	—	—	200	26	158	8·1
Carmarthen -	4,201	3,802	5	—	345	10	39	1·1
Carnarvon -	3,181	2,857	2	—	272	22	28	1·5
Denbigh - -	2,711	2,317	1	—	272	49	72	4·4
Flint - -	2,695	2,384	3	—	244	10	54	2·3
Glamorgan -	17,518	15,297	16	12	1,623	75	495	3·2
Merioneth -	2,032	1,740	—	—	202	34	56	4·4
Montgomery -	2,127	1,720	3	—	212	11	181	9·0
Pembroke -	2,455	2,152	1	—	209	41	52	2·8
Radnor - -	637	404	—	—	65	19	149	26·3

UNIONS.

METROPOLITAN UNIONS.								
Bethnal Green -	5,036	3,993	4	—	508	16	515	10·5
Camberwell -	4,509	3,699	2	—	417	26	365	8·6
Chelsea - -	2,350	1,936	7	—	266	3	138	6·0
Fulham - -	2,661	2,225	8	—	243	15	170	6·9
George's, St. -	4,284	3,689	29	—	381	10	175	4·3
George St., East -	1,855	1,408	3	—	207	16	221	12·7
Giles and George, S.S.	1,770	1,330	1	—	179	12	248	14·6
Greenwich -	3,975	3,503	4	—	323	15	130	3·6
Hackney - -	4,453	3,113	8	1	401	101	829	20·8
Hampstead -	870	777	2	—	20	7	64	8·1
Holborn - -	6,194	4,996	5	—	659	47	487	8·6
Islington - -	8,416	7,125	16	—	700	62	513	6·8
Kensington -	4,111	3,395	17	—	395	26	278	7·3
Lambeth - -	8,348	6,469	30	2	817	14	1,016	12·3
Lewisham -	1,776	1,610	4	—	121	2	39	2·3
London, City -	1,752	1,466	5	—	167	43	71	6·5
Mary-le-bone -	5,003	3,925	7	—	554	26	491	10·3
Mile End Old Town.	3,860	3,109	10	—	363	30	348	9·7
Olave, St. -	4,972	4,173	12	—	452	18	317	6·7
Paddington -	2,832	2,316	7	—	252	52	205	9·0
Pancras, St. -	7,961	6,530	29	—	695	5	702	8·8
Poplar - -	5,223	4,387	9	—	516	9	302	5·9
Saviour, St. -	6,805	5,290	3	—	725	69	718	11·5
Shoreditch -	5,081	4,092	14	1	478	45	451	9·7
Stepney - -	2,074	1,576	—	—	222	14	262	13·3
Strand - - -	1,020	831	3	—	94	3	89	9·0
Wandsworth and Clapham.	4,951	4,342	6	—	415	21	167	3·8
Westminster -	1,363	1,181	—	—	135	4	43	3·4
Whitechapel -	2,667	2,155	1	—	262	34	215	9·3
Woolwich -	2,484	2,133	5	—	226	9	111	4·8

App. No. 2.

Digest of Vaccination Returns.

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.
BEDFORDSHIRE.							
Ampthill	616	539	—	—	68	3	6
Bedford	1,354	1,219	—	—	125	6	4
Biggleswade	1,001	878	—	—	112	2	9
Leighton Buzzard	702	615	—	—	68	1	18
Luton	1,224	1,017	—	—	151	18	38
Woburn	326	289	—	—	32	1	4
BERKS.							
Abingdon	660	594	2	—	60	2	2
Bradfield	519	484	—	—	34	1	—
Cookham	481	442	—	—	24	5	10
Easthampstead	290	272	1	—	12	3	2
Faringdon	449	399	2	—	39	2	7
Hungerford	551	485	—	—	50	9	7
Newbury	601	528	4	—	50	12	7
Reading	1,362	1,192	—	—	135	12	23
Wallingford	446	407	1	—	30	—	8
Wantage	555	501	—	—	42	2	10
Windsor	813	696	—	—	61	2	54
Wokingham	504	458	—	—	30	4	12
BUCKS.							
Amersham	688	624	1	—	52	2	9
Aylesbury	804	705	—	—	60	12	27
Buckingham	406	352	2	—	37	4	11
Eton	823	726	—	—	66	1	30
Newport Pagnell	847	747	—	—	91	2	7
Winslow	282	263	—	—	15	1	3
Wycombe	1,373	1,207	6	—	140	4	16
CAMBRIDGE.							
Cambridge	1,002	877	—	—	91	9	25
Caxton and Arrington	384	353	—	—	30	—	1
Chesterton	962	841	—	—	87	8	26
Ely	763	637	1	—	89	2	34
Linton	456	406	—	—	35	5	10
Newmarket	970	856	1	—	81	—	32
North Witchford	527	465	—	—	56	1	5
Whittlesey	217	189	—	—	24	1	3
Wisbeach	1,162	1,005	1	—	123	5	28
CHESHIRE.							
Altrincham	1,665	1,471	1	—	140	5	48
Birkenhead	3,205	2,693	2	—	275	35	200
Tarvin	331	300	—	—	21	1	9
Chester	1,419	1,236	2	—	137	—	44
Congleton	1,366	1,221	1	1	131	5	7
Macclesfield	1,992	1,717	1	—	252	6	16
Nantwich	1,974	1,665	1	—	176	7	125
Northwich	1,387	1,240	2	—	137	1	7
Runcorn	1,201	1,081	—	—	102	3	15
Stockport	3,656	3,142	2	—	397	17	98
Wirrall	785	708	—	—	60	3	14

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.
CORNWALL.							
Austell, St.	1,066	938	2	1	106	3	16
Bodmin	569	494	—	—	45	3	27
Camelford	263	232	1	—	28	—	2
Columb, St., Major	518	456	—	—	46	6	10
Falmouth	737	643	—	—	76	7	11
Germans, St.	516	469	—	—	38	4	5
Helston	857	706	1	1	95	3	51
Launceston	500	467	—	—	28	2	3
Liskeard	988	887	—	—	55	7	39
Penzance	1,817	1,535	3	1	238	17	23
Redruth	1,728	1,466	3	—	204	15	40
Stratton	245	195	—	—	14	11	25
Truro	1,170	972	4	2	134	14	44
CUMBERLAND.							
Alston with Garrigill	163	144	—	—	18	—	1
Bootle	337	297	—	—	33	—	7
Brampton	282	251	—	—	28	—	3
Carlisle	1,463	1,327	—	—	129	—	7
Cockermouth	1,922	1,720	3	2	181	5	11
Longtown	243	214	—	—	20	7	2
Penrith	763	686	2	—	63	3	9
Whitehaven	2,092	1,763	1	5	244	8	71
Wigton	697	620	—	—	60	2	15
DERBYSHIRE.							
Ashbourne	600	541	—	—	47	2	10
Bakewell	888	761	—	—	86	—	41
Belper	2,000	1,790	4	—	196	3	7
Chapel-en-le-Frith	506	431	1	—	47	3	24
Chesterfield	3,630	3,138	10	—	394	16	72
Derby	2,522	2,130	3	—	336	8	45
Glossop	695	567	1	—	96	—	31
Hayfield	405	346	—	—	43	7	9
Shardlow	1,239	1,065	1	—	141	12	20
DEVONSHIRE.							
Axminster	533	469	—	—	43	6	15
Barnstaple	1,090	992	1	1	77	7	12
Bideford	616	567	—	—	39	1	9
Crediton	531	489	—	—	31	—	11
East Stonehouse	590	517	—	—	58	6	9
Exeter	1,051	865	—	—	137	4	45
Holsworthy	300	273	—	—	15	1	11
Honiton	746	634	4	—	90	4	14
Kingsbridge	619	539	1	—	55	7	17
Newton Abbott	1,943	1,737	—	—	151	14	41
Okehampton	553	449	—	—	29	—	75
Plymouth	2,092	1,771	2	—	230	26	63
Plympton St. Mary	652	550	—	—	45	28	29
South Molton	536	473	—	—	43	2	18
Stoke Damerel	1,488	1,343	—	—	104	8	33
Tavistock	921	816	2	—	61	1	41
Thomas, St.	1,405	1,232	—	—	118	14	41
Tiverton	845	753	1	—	79	1	11
Torrington	453	401	1	—	29	6	16
Totnes	1,133	1,045	1	—	67	4	16

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Digest of Vaccination Returns.

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.
DORSET.							
Beaminster	384	342	—	—	27	7	8
Blandford	379	268	—	—	16	2	93
Bridport	559	488	—	—	49	4	18
Cerne	213	198	—	—	10	—	5
Dorchester	523	481	—	—	36	2	4
Poole	496	440	—	—	38	7	11
Shaftesbury	365	306	—	—	32	4	23
Sherborne	411	363	—	—	33	—	15
Sturminster	309	281	—	—	21	2	5
Wareham and Purbeck	492	447	—	—	31	1	13
Weymouth	871	781	1	—	51	1	37
Wimborne and Cranborne	501	451	—	—	37	6	7
DURHAM.							
Auckland	3,588	2,972	3	—	476	—	137
Chester-le-Street	1,668	1,460	—	—	193	1	14
Darlington	1,727	1,381	1	2	204	9	130
Durham	2,746	2,338	11	—	276	24	97
Easington	1,742	1,482	3	—	202	8	47
Gateshead*	2,926	2,264	1	—	373	29	259
Hartlepool	1,905	1,657	1	2	221	7	17
Houghton-le-Spring	1,353	1,154	—	—	145	1	53
Lanchester	2,152	1,862	1	2	237	6	44
Sedgefield	816	669	—	—	101	12	34
South Shields	3,772	3,064	2	—	421	—	285
Stockton	4,496	3,864	5	—	463	50	114
Sunderland	5,367	4,585	6	—	609	6	161
Teesdale	631	559	—	—	56	6	10
Weardale	685	583	—	—	76	—	26
ESSEX.							
Billericay	491	432	1	—	38	11	9
Braintree	594	541	2	—	43	1	7
Chelmsford	1,022	895	1	—	101	6	19
Colchester	860	753	1	—	76	7	23
Dunmow	590	538	1	—	43	2	6
Epping	623	533	1	1	47	2	39
Halstead	521	449	—	—	49	5	18
Lexden and Winstree	831	740	—	—	80	—	11
Maldon	831	746	—	—	59	—	26
Ongar	337	276	—	—	26	2	33
Orsett	431	393	—	—	30	—	8
Rochford	723	647	2	—	62	—	12
Romford	1,142	946	2	—	110	13	71
Saffron Walden	592	528	—	—	48	3	13
Tendring†	—	—	—	—	—	—	—
West Ham	4,329	3,890	—	—	371	11	57
Witham	462	424	—	—	25	—	13
GLOUCESTERSHIRE.							
Bristol	2,021	1,701	—	—	210	3	107
Cheltenham	1,369	1,029	—	1	142	—	197
Chipping Sodbury	502	403	—	—	52	—	47
Cirencester	680	601	1	—	54	5	19

* No returns from Heworth and Whickham sub-districts (958 births registered).
† No returns from Tendring Union (914 births registered).

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.
GLOUCESTER—*cont.*							
Clifton	4,976	4,284	2	—	466	7	217
Dursley	348	316	—	—	26	3	3
Gloucester	1,401	1,224	1	—	132	4	40
Newent	319	287	—	—	28	3	1
Northleach	306	277	—	—	22	1	6
Stow-on-the-Wold	286	239	6	—	24	2	15
Stroud	1,273	1,148	1	—	107	1	16
Tetbury	166	156	—	—	10	—	—
Tewkesbury	426	379	1	—	40	2	4
Thornbury	582	534	—	—	35	3	10
Westbury-on-Severn	923	829	—	—	67	2	25
Wheatenhurst	204	193	—	—	10	—	1
Winchcomb	284	240	—	—	26	—	18
HEREFORDSHIRE.							
Bromyard	337	291	—	—	38	4	4
Dore	234	216	—	—	12	1	5
Hereford	915	809	—	—	84	2	20
Kington	333	288	—	—	31	—	14
Ledbury	376	327	—	—	28	3	18
Leominster	404	320	—	—	33	7	44
Ross	506	460	—	—	34	—	12
Weobley	229	188	3	—	11	4	23
HERTS.							
St. Albans	733	653	—	—	69	—	11
Barnet	779	701	—	—	64	1	13
Berkhampstead	509	447	—	—	42	1	19
Bishop's Stortford	668	619	—	—	40	1	8
Buntingford	218	194	—	—	17	3	4
Hatfield	205	187	—	—	16	1	1
Hemel Hempstead	459	401	—	—	49	1	8
Hertford	491	433	—	1	37	5	15
Hitchin	953	849	3	—	91	—	10
Royston	652	584	—	—	59	3	6
Ware	525	485	3	—	27	—	10
Watford	858	780	3	—	56	3	16
Welwyn	78	75	—	—	2	—	1
HUNTS.							
Huntingdon	658	595	—	—	51	5	7
St. Ives	567	526	—	—	39	—	2
St. Neots	624	556	—	—	55	4	9
KENT (extra-metropolitan).							
Ashford, East	404	369	4	—	22	4	5
Ashford, West	538	487	—	—	41	2	8
Blean	590	547	—	—	38	—	5
Bridge	328	291	—	—	27	—	10
Bromley	1,216	1,024	2	—	115	4	71
Canterbury	498	428	—	—	55	4	11
Cranbrook	418	368	2	—	30	1	17
Dartford	1,525	1,373	1	—	113	10	28
Dover	1,099	919	1	—	116	6	57

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Digest of Vaccination Returns.

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.
KENT—*cont.*							
Eastry	835	750	2	—	55	10	18
Elham	866	799	1	—	51	4	11
Faversham	795	727	—	—	63	2	3
Gravesend and Milton	588	531	—	—	49	—	8
Hollingbourn	452	402	2	—	42	1	5
Hoo	113	100	1	—	7	1	4
Maidstone	1,343	1,185	2	—	112	11	33
Malling	800	718	—	—	64	1	17
Medway	1,809	1,617	2	1	157	1	31
Milton	766	703	1	—	53	—	9
North Aylesford	815	739	1	—	66	—	9
Romney Marsh	191	168	—	—	19	—	4
Seven Oaks	812	738	—	—	51	7	16
Sheppey	580	522	—	—	37	1	20
Tenterden	342	302	—	—	30	—	10
Thanet, I. of	1,292	1,144	—	—	127	5	16
Tonbridge	1,505	1,362	3	—	110	10	20
LANCASHIRE.							
Ashton-under-Lyne	5,177	4,554	2	—	524	14	83
Barton-upon-Irwell	2,031	1,725	—	—	197	14	95
Blackburn	5,978	5,321	5	—	605	3	44
Bolton	6,609	5,805	3	—	650	1	150
Burnley	3,475	3,027	5	—	374	21	48
Bury	4,121	3,596	3	—	429	15	78
Chorley	1,580	1,376	1	—	178	3	22
Chorlton	8,563	7,340	3	—	904	17	299
Clitheroe	691	604	1	—	72	4	10
Fylde, The	1,049	943	—	—	87	—	19
Garstang	384	350	—	—	27	—	7
Haslingden	3,073	2,715	1	—	298	9	50
Lancaster	1,092	956	—	—	111	11	14
Leigh	1,799	1,601	2	—	163	—	33
Liverpool	7,893	6,441	3	—	972	8	469
Lunesdale	194	184	—	—	7	1	2
Manchester	6,797	5,726	4	2	805	4	256
Oldham	5,265	4,519	5	—	571	15	155
Ormskirk	2,006	1,786	1	—	183	7	29
Prescot	4,095	3,439	—	—	431	15	210
Preston	4,519	3,910	2	2	449	18	138
Prestwich	3,222	2,824	3	—	276	9	110
Rochdale	4,039	3,363	4	—	468	27	177
Salford	5,791	4,974	3	—	609	27	178
Todmorden	1,078	920	—	—	137	1	20
Toxteth Park	3,371	2,916	3	—	261	11	180
Ulverstone	2,943	2,491	2	—	287	37	126
Warrington	2,343	1,762	1	—	181	8	391
West Derby	10,731	9,395	7	—	963	18	348
Wigan	5,441	4,854	1	—	535	6	45
LEICESTERSHIRE.							
Ashby-de-la-Zouch	1,073	792	—	—	110	1	170
Barrow-on-Soar	810	662	—	—	104	2	42
Billesdon	198	173	—	—	17	—	8
Blaby	538	443	1	—	74	10	10
Hinckley	631	539	1	—	79	1	11
Leicester	4,446	3,730	6	—	555	5	150

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.
LEICESTERSHIRE —*cont.*							
Loughborough - -	780	648	1	—	100	5	26
Lutterworth - -	372	350	—	—	18	1	3
Market Bosworth -	482	415	—	—	57	1	9
Market Harborough -	495	443	—	—	40	2	10
Melton Mowbray - -	619	529	—	—	67	13	10
LINCOLNSHIRE.							
Boston - - -	1,185	1,016	—	—	114	7	48
Bourn - - -	612	539	1	—	53	1	18
Caistor - - -	1,785	1,321	—	—	321	8	135
Gainsborough - -	821	663	1	—	94	12	51
Glanford Brigg - -	1,220	1,082	—	—	114	5	19
Grantham - -	999	898	—	—	84	5	12
Holbeach - - -	644	557	2	—	67	1	17
Horncastle - -	676	607	1	—	49	2	17
Lincoln - - -	1,900	1,433	2	—	258	41	166
Louth - - -	1,065	922	—	—	89	16	38
Sleaford - - -	724	651	—	—	64	4	5
Spalding - - -	737	658	2	—	65	1	11
Spilsby - - -	899	753	2	—	69	7	68
Stamford - - -	572	489	—	—	53	8	22
MIDDLESEX (extra-metropolitan).							
Brentford - - -	2,485	1,742	4	—	199	5	535
Edmonton - -	3,090	2,578	5	2	274	10	221
Hendon - - -	1,427	1,085	32	—	108	15	187
Staines - - -	701	613	—	1	56	3	28
Uxbridge - - -	780	693	—	1	64	1	21
MONMOUTHSHIRE.							
Abergavenny - -	813	689	—	—	98	5	21
Bedwelty - - -	2,389	2,072	2	—	204	11	100
Chepstow - - -	570	501	1	—	45	10	13
Monmouth - -	1,087	939	2	—	108	4	34
Newport - - -	2,393	2,096	1	—	237	1	45
Pontypool - -	1,436	1,025	—	—	135	1	275
NORFOLK.							
Aylsham - - -	524	477	—	—	29	—	18
Blofield - - -	338	290	—	—	39	4	5
Depwade - -	772	630	6	—	82	11	43
Docking - - -	583	501	1	—	67	2	12
Downham - -	627	545	—	1	67	3	11
Erpingham - -	582	519	—	—	49	3	11
Faith, St. - - -	351	320	—	—	29	1	1
Flegg, E. and W. -	311	232	—	—	34	1	44
Forehoe - - -	347	289	—	—	43	5	10
Freebridge Lynn - -	384	342	—	—	37	2	3
Guiltcross - -	301	259	—	—	29	5	8
Henstead - -	292	258	—	—	27	—	7
King's Lynn - -	460	400	3	1	50	—	6
Loddon and Clavering -	405	362	—	—	32	1	10
Mitford and Launditch -	793	716	—	—	60	2	15
Norwich - - -	2,668	2,318	2	—	286	2	60
Swaffham - - -	328	289	—	—	23	1	15

App. No. 2.

Digest of Vaccination Returns.

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.
NORFOLK—*cont.*							
Thetford	580	526	—	—	32	1	21
Smallburgh	453	383	—	—	51	—	19
Walsingham	532	470	—	—	43	2	17
Wayland	329	271	1	—	45	4	8
Yarmouth, Gt.	1,108	909	—	—	162	13	24
NORTHAMPTONSHIRE							
Brackley	412	346	3	—	46	3	14
Brixworth	363	309	—	—	38	3	13
Daventry	603	519	2	1	59	—	22
Hardingstone	359	326	—	—	29	1	3
Kettering	846	753	—	—	80	1	12
Northampton	2,055	1,680	3	—	222	8	142
Oundle	427	376	—	—	42	2	7
Peterborough	1,327	1,172	—	—	138	2	15
Potterspury	410	341	—	—	42	5	22
Thrapston	551	486	—	—	59	1	5
Towcester	429	381	1	—	40	2	5
Wellingborough	1,266	1,035	—	—	162	18	51
NORTHUMBERLAND.							
Alnwick	592	511	3	—	55	4	19
Belford	156	141	1	—	10	1	3
Bellingham	188	174	—	—	11	—	3
Berwick-on-Tweed	599	541	—	—	44	9	5
Castle Ward	683	605	—	—	72	1	5
Glendale	318	298	3	—	12	—	5
Haltwhistle	222	205	1	—	13	1	2
Hexham	1,058	917	3	—	93	5	40
Morpeth	1,654	1,487	7	—	144	4	12
Newcastle-on-Tyne	5,722	4,770	9	1	732	20	190
Rothbury	171	154	—	—	11	—	6
Tynemouth	4,300	3,692	6	—	458	29	115
NOTTINGHAMSHIRE.							
Basford	3,897	3,302	1	—	451	14	129
Bingham	406	358	—	—	40	2	6
East Retford	652	581	—	—	64	1	6
Mansfield	1,476	1,234	2	—	167	12	61
Newark	938	832	1	—	83	1	21
Nottingham	3,237	2,396	2	—	423	78	338
Radford	1,397	1,113	—	—	187	19	78
Southwell	569	519	—	—	24	—	26
Worksop	923	833	1	1	75	2	11
OXFORDSHIRE.							
Banbury	992	710	—	—	97	3	182
Bicester	491	420	—	—	50	5	16
Chipping Norton	609	538	1	—	61	1	8
Headington	760	606	—	—	81	7	66
Henley	572	516	2	—	35	3	16
Oxford	655	565	1	—	69	4	16
Thame	476	424	—	—	43	—	9
Witney	752	655	—	—	88	2	7
Woodstock	434	375	2	—	34	11	12

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.
RUTLAND.							
Oakham	354	323	1	—	24	3	3
Uppingham	353	307	—	—	41	—	5
SALOP.							
Atcham	1,289	1,156	1	—	114	8	10
Bridgenorth	458	411	—	—	36	1	10
Church Stretton	189	174	—	—	9	1	5
Cleobury Mortimer	238	219	—	—	17	2	—
Clun	333	272	4	—	26	2	29
Drayton	423	381	—	—	32	1	9
Ellesmere	339	305	—	—	31	3	—
Ludlow	553	468	—	—	53	2	30
Madeley	1,099	969	4	—	108	2	16
Newport	482	417	—	—	41	1	23
Oswestry	862	793	—	—	58	—	11
Shiffnall	439	401	1	—	26	1	10
Wellington	1,046	937	—	—	104	—	5
Wem	301	272	—	—	25	2	2
Whitchurch	371	282	—	—	41	—	48
SOMERSET.							
Axbridge	1,073	963	2	—	87	6	15
Bath	1,908	1,591	2	—	179	3	133
Bedminster	2,223	1,937	—	—	197	22	67
Bridgwater	1,068	965	7	—	79	2	15
Chard	842	735	3	—	78	5	21
Clutton	713	639	1	—	55	—	18
Dulverton	179	165	—	—	11	—	3
Frome	717	655	1	—	48	3	10
Keynsham	844	747	—	—	74	1	22
Langport	525	471	—	—	33	1	20
Shepton Mallet	530	474	1	—	39	4	12
Taunton	947	837	1	—	91	4	14
Wellington	561	515	—	—	29	1	16
Wells	598	510	2	—	49	11	26
Williton	554	511	—	—	31	1	11
Wincanton	615	551	3	—	46	4	11
Yeovil	883	753	—	—	92	9	29
SOUTHAMPTON.							
Alresford	213	186	—	—	23	1	3
Alton	470	404	—	—	47	2	17
Alverstoke	782	722	1	—	53	—	6
Andover	527	489	2	—	32	1	3
Basingstoke	589	519	—	—	36	11	23
Catherington	85	76	—	—	6	—	3
Christchurch	532	466	1	—	35	13	17
Droxford	336	298	1	—	25	1	11
Fareham	508	454	—	—	43	1	10
Fordingbridge	217	207	—	—	8	—	2
Hartley Wintney	582	523	—	—	35	2	22
Havant	278	233	1	—	18	—	26

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Digest of Vaccination Returns.

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.
SOUTHAMPTON—*cont.*							
Hursley	86	81	—	—	5	—	—
Kingsclere	227	182	—	—	24	1	20
Lymington	332	287	—	—	24	3	18
New Forest	387	349	—	—	29	4	5
Petersfield	308	285	—	—	18	2	3
Portsea Island	4,044	3,629	4	2	349	9	51
Ringwood	149	141	—	—	4	—	4
Romsey	314	241	1	—	34	5	33
Southampton	1,541	1,207	2	—	160	27	145
South Stoneham	1,075	899	2	—	102	28	44
Stockbridge	216	203	1	—	11	—	1
Whitchurch	170	155	—	—	12	—	3
Wight, Isle of	1,901	1,669	14	—	124	33	61
Winchester	739	660	1	—	45	9	24
STAFFORDSHIRE.							
Wolstanton and Burslem	3,514	3,107	—	—	370	6	31
Burton-on-Trent	2,250	1,486	1	—	167	11	585
Cheadle	781	702	—	—	62	4	13
Leek	1,089	836	1	—	119	5	128
Lichfield	1,210	1,051	2	—	130	6	21
Newcastle-under-Lyme	1,254	1,091	—	—	129	—	34
Penkridge	1,049	867	1	—	119	6	56
Seisdon	481	432	—	—	39	3	7
Stafford	970	853	2	—	94	7	14
Stoke-on-Trent	3,970	3,442	1	—	413	9	105
Stone	857	784	1	—	64	1	7
Tamworth	681	552	1	1	67	11	49
Uttoxeter	426	404	—	—	17	1	4
Walsall	3,372	2,871	3	—	374	15	109
West Bromwich	4,863	4,348	4	3	467	2	39
Wolverhampton	5,163	4,551	5	—	546	2	59
SUFFOLK.							
Blything	816	725	—	—	50	8	33
Bosmere and Claydon	477	412	—	—	40	6	19
Bury St. Edmunds	475	409	—	—	51	4	11
Cosford	527	472	1	—	42	—	12
Hartismere	524	482	—	—	33	1	8
Hoxne	452	401	—	—	35	—	16
Ipswich	1,529	1,353	—	—	139	15	22
Mildenhall	293	270	—	—	14	1	8
Mutford and Lothingland	1,148	944	1	—	131	4	68
Plomesgate	578	522	—	—	38	4	14
Risbridge	591	546	—	—	33	2	10
Stamford	369	323	—	—	36	—	10
Stow	685	608	—	—	58	1	18
Sudbury	994	828	—	—	99	2	65
Thingoe	515	451	2	—	47	1	14
Wangford	446	385	—	—	45	4	12
Woodbridge	637	579	—	—	51	3	4

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.
SURREY (extra-metropolitan).							
Chertsey	759	640	—	—	54	13	52
Croydon	2,967	2,419	3	1	260	72	212
Dorking	436	407	—	—	24	—	5
Epsom	933	759	1	—	63	14	96
Farnham	1,400	1,205	—	—	112	11	72
Godstone	416	377	—	—	27	2	10
Guildford	1,074	945	—	—	80	20	29
Hambledon	453	411	—	—	24	8	10
Kingston	1,898	1,592	2	—	153	19	132
Reigate	884	802	—	—	57	9	16
Richmond	787	708	1	—	66	2	10
SUSSEX.							
Battle	463	432	—	—	25	5	1
Brighton	2,782	2,407	1	—	284	20	70
Chailey	288	264	—	—	22	—	2
Chichester	228	184	—	—	15	—	29
Cuckfield	613	535	—	—	50	9	19
Eastbourne	497	419	—	—	30	3	45
East Grinstead	544	496	—	—	36	6	6
East Preston	641	571	2	—	53	9	6
Hailsham	413	356	1	—	26	4	26
Hastings	1,038	837	—	—	87	70	44
Horsham	616	562	—	—	36	6	12
Lewes	320	280	—	—	32	2	6
Midhurst	396	359	—	—	28	3	6
Newhaven	217	166	8	—	28	6	9
Petworth	313	293	—	—	14	5	1
Rye	352	310	—	—	26	—	16
Steyning	954	794	8	—	90	9	53
Thakeham	285	266	—	—	15	—	4
Ticehurst	592	513	—	—	47	5	27
Uckfield	649	603	—	—	34	1	11
Westbourne	215	184	—	—	12	4	15
West Firle	60	56	—	—	3	1	—
West Hampnett	496	440	1	—	34	7	14
WARWICKSHIRE.							
Alcester	636	548	1	—	76	2	9
Aston	6,825	5,976	6	4	700	7	132
Atherstone	428	384	—	—	34	3	7
Birmingham	9,295	7,949	10	4	1,010	20	302
Coventry	1,531	1,294	2	—	199	8	28
Foleshill	633	526	—	—	96	—	11
Meriden	273	243	—	—	17	4	9
Nuneaton	465	365	—	—	68	—	32
Rugby	715	641	—	—	58	—	16
Solihull	400	370	—	—	19	2	9
Southam	395	342	1	—	38	6	8
Stratford-on-Avon	704	620	1	—	55	2	26
Warwick	1,367	1,230	2	—	115	2	18

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Digest of Vaccination Returns.

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.
WESTMORELAND.							
East Ward - -	493	429	1	—	56	1	6
Kendal - - -	1,272	1,170	4	—	88	5	5
West Ward - -	216	203	2	—	11	—	—
WILTSHIRE.							
Alderbury - -	726	673	1	—	43	—	9
Amesbury - -	251	232	—	—	17	—	2
Bradford - - -	305	282	—	—	22	—	1
Calne - - -	265	250	—	—	13	1	1
Chippenham - -	635	570	—	—	37	16	12
Cricklade and Wootton Bassett.	378	317	1	—	43	6	11
Devizes - - -	585	541	—	—	37	2	5
Highworth and Swindon -	1,181	1,058	1	—	84	10	28
Malmesbury - -	453	412	—	—	29	1	11
Marlborough - -	280	263	—	—	14	—	3
Melksham - - -	611	530	—	—	67	2	12
Mere - - -	250	221	—	—	24	—	5
Pewsey - - -	352	315	—	—	22	1	14
Tisbury - - -	281	259	—	—	14	1	7
Warminster - -	451	412	—	—	31	5	3
Westbury and Whorwelsdown.	387	339	1	—	39	3	5
Wilton - - -	305	259	—	—	35	2	9
WORCESTERSHIRE.							
Bromsgrove - -	1,056	927	2	—	109	2	16
Droitwich - - -	763	655	—	—	84	2	22
Dudley - - -	6,514	5,550	9	1	719	50	185
Evesham - - -	507	453	—	—	42	2	10
Kidderminster - -	1,195	932	5	—	156	20	82
King's Norton - -	2,516	2,224	6	—	216	20	50
Martley - - -	465	409	—	—	33	1	22
Pershore - - -	424	392	—	—	29	—	3
Shipston-on-Stour* -	423	332	—	—	42	1	48
Stourbridge - -	3,254	2,813	2	6	358	10	65
Tenbury - - -	218	184	—	—	19	—	15
Upton-on-Severn - -	555	510	1	—	38	—	6
Worcester - - -	988	723	—	—	85	—	180
YORKSHIRE. (East Riding.)							
Beverley - - -	689	540	—	—	76	2	71
Bridlington - -	535	439	1	—	73	7	15
Driffield - - -	654	560	3	—	80	4	7
Howden - - -	415	371	—	—	41	1	2
Kingston-upon-Hull -	2,611	2,263	12	—	278	3	55
Patrington - -	265	237	—	—	18	1	9
Pocklington - -	517	438	—	—	57	2	20
Sculcoates - -	3,003	2,532	3	—	326	16	126
Skirlaugh - - -	327	290	4	—	31	1	1
York - - -	2,102	1,817	11	—	185	16	73

* No returns from Moreton in Marsh sub-district (179 births registered).

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.
YORKSHIRE. (North Riding.)							
Aysgarth	142	123	—	—	17	1	1
Bedale	253	221	—	—	32	—	—
Easingwold	280	247	—	—	23	1	9
Guisborough	2,234	1,747	1	2	282	18	184
Helmsley Blackmoor	189	166	—	—	21	1	1
Kirkby Moorside	181	157	—	—	21	3	—
Leyburn	230	205	—	—	23	—	2
Malton	770	656	2	—	83	12	17
Northallerton	329	290	—	—	30	—	9
Pickering	489	390	3	—	63	6	27
Reeth	147	136	—	—	9	1	1
Richmond	382	348	—	—	24	4	6
Scarborough	1,161	977	1	—	143	11	29
Stokesley	344	308	2	—	27	5	2
Thirsk	388	352	—	—	27	1	8
Whitby	921	818	—	—	80	11	12
YORKSHIRE. (West Riding.)							
Barnsley	2,815	2,412	2	—	301	24	76
Bramley	1,928	1,649	1	—	199	2	77
Bradford	6,267	5,154	3	—	829	1	280
Bierley, North	4,422	3,774	1	—	510	24	113
Dewsbury	5,358	2,886	9	2	726	3	1,732
Doncaster	1,595	1,382	1	—	157	8	47
Eccleshall Bierlow	3,824	3,296	7	—	397	4	120
Goole	643	564	1	—	64	4	10
Halifax	5,552	5,030	2	1	459	12	48
Hemsworth	245	225	—	—	19	—	1
Holbeck	995	854	—	1	126	1	13
Huddersfield	5,167	4,562	3	2	532	5	63
Hunslet	2,186	1,858	1	—	301	2	24
Keighley	1,931	903	—	—	240	—	788
Knaresborough	574	494	5	—	59	3	13
Leeds	6,867	5,954	2	1	825	13	72
Ouseburn, Gt.	369	332	—	—	25	3	9
Pateley Bridge	257	242	—	—	14	1	—
Penistone	637	567	1	—	64	1	4
Pontefract	1,724	1,499	2	—	182	10	31
Ripon	478	436	—	—	31	5	6
Rotherham	2,756	2,403	2	1	285	9	56
Saddleworth	701	602	—	—	72	—	27
Sedbergh*	91	78	2	—	9	1	1
Selby	511	446	—	—	56	1	8
Settle	473	420	—	—	44	1	8
Sheffield	7,431	5,876	6	1	923	32	593
Skipton	1,050	911	—	—	107	4	28
Tadcaster	792	658	—	—	81	1	52
Thorne	522	414	—	—	51	3	54
Wakefield	2,915	2,414	4	—	304	3	190
Wetherby	412	341	2	—	29	10	30
Wharfedale	1,423	1,188	—	—	168	8	59
Wortley	1,346	1,088	—	—	142	4	112

* No return from Sedbergh sub-district (57 births registered).

App. No. 2.

Digest of Vaccination Returns.

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.
ANGLESEY.							
Anglesey	426	374	—	—	32	2	18
Holyhead	480	415	—	—	42	6	17
BRECKNOCK.							
Brecknock	495	450	—	—	35	1	9
Builth	264	236	—	—	18	—	10
Crickhowell	735	609	—	—	78	34	14
Hay	316	267	—	—	31	—	18
CARDIGAN.							
Aberaeron	371	307	—	—	37	9	18
Aberystwith	799	644	—	—	65	13	77
Cardigan	477	410	—	—	33	—	34
Lampeter	293	242	—	—	37	2	12
Tregaron	319	272	—	—	28	2	17
CARMARTHEN.							
Carmarthen	1,061	949	—	—	89	7	16
Llanelly	1,564	1,409	—	—	145	1	9
Llandilo Fawr	601	557	—	—	38	2	4
Llandovery	437	397	5	—	33	—	2
Newcastle-in-Emlyn	538	490	—	—	40	—	8
CARNARVON.							
Bangor and Beaumaris	989	894	1	—	81	4	9
Carnarvon	1,193	1,059	—	—	113	10	11
Conway	388	354	—	—	27	5	2
Pwllheli	611	550	1	—	51	3	6
DENBIGH.							
Llanrwst	377	293	—	—	40	17	27
Ruthin	392	352	—	—	33	3	4
Wrexham	1,942	1,672	1	—	199	29	41
FLINT.							
St. Asaph	728	646	—	—	70	2	10
Hawarden	550	501	1	—	46	—	2
Holywell	1,417	1,237	2	—	128	8	42
GLAMORGAN.							
Bridgend and Cowbridge	1,113	990	—	—	82	2	39
Cardiff	2,889	2,410	2	—	313	14	150
Gower	315	286	—	—	23	2	4
Merthyr Tydfil	4,541	4,082	4	7	404	1	43
Neath	2,860	2,549	—	—	265	10	36
Pontypridd	2,732	2,329	9	5	306	15	68
Swansea	3,068	2,651	1	—	230	31	155

—	Births.	Successfully Vaccinated.	Insusceptible of Vaccination.	Had Small Pox.	Dead, Unvaccinated.	Vaccination postponed.	Remaining.
MERIONETH.							
Bala - - -	184	158	—	—	17	5	4
Corwen - - -	502	440	—	—	35	6	21
Dolgelly - - -	467	418	—	—	43	—	6
Festiniog - - -	879	724	—	—	107	23	52
MONTGOMERY.							
Llanfyllin* - -	428	354	—	—	59	1	14
Machynlleth - -	352	319	—	—	22	2	9
Forden - - -	547	490	—	—	42	4	11
Newtown and Llanidloes -	800	557	3	—	89	4	147
PEMBROKE.							
Haverfordwest - -	976	849	—	—	84	16	27
Narberth - - -	623	566	—	—	43	4	10
Pembroke - - -	856	737	1	—	82	21	15
RADNOR.							
Knighton - - -	328	175	—	—	38	9	106
Presteigne - -	105	87	—	—	8	4	6
Rhayader - - -	204	142	—	—	19	6	37

* No return for first half of 1873 from Llansaintfraid sub-district (130 births registered).

App. No. 3.

National Vaccine Establishment.

No. 3

Statistics of the National Vaccine Establishment and Educational Vaccinating Stations.

I.—Staff at end of 1875.

N.B.—The stations named in *italics* are Educational Vaccinating Stations, authorised by the Lords of the Privy Council, for the purposes of their Lordships' Order of December 1, 1859.

—	Name.	Vaccinating Station.	Day and Hour of Attendance.
Vaccinators supplying lymph for the public service, & salaried from the Parliamentary grant -	1. Mr. J. F. Marson -	*Surrey Chapel* -	Tues., Thurs.; 1.
	2. Mr. W. E. G. Pearse -	*Tottenham Court Chapel.*	Mon., Wednes.; 1.
Parochial and other Vaccinators not salaried from the Parliamentary grant, but contributing lymph at a fixed rate of payment.	1. Mr. E. S. Guest - -	*Manchester* -	Monday; 2.
	2–5. Dr. E. Robinson	*Birmingham*	2. Monday - 3. Tuesday - 4. Wednesday 5. Thursday - } 11
	6. Dr. H. A. P. Robertson	*Bristol* - -	Wednesday; 10.
	7. Mr. A. B. Steele - -	*Liverpool* - -	Thursday; 2.
	8. Mr. E. L. Webb - -	*Pimlico* - -	Thursday; 10.
	9. Mr. J. Hawthorn - -	*Newcastle-on-Tyne.*	Wednesday; 3.
	10. Mr. W. E. G. Pearse -	*Westminster* -	Tuesday; 2.
	11–12. Mr. W. A. Summer	*Marylebone*	Monday - Wednesday } 10.
	13. Mr. C. T. Blackman -	*Whitechapel* -	Wednesday; 11.
	14. Mr. F. Holmes - -	*Leeds* - -	Tuesday; 2.30.
	15. Dr. E. Lynes - -	Coventry - -	Tuesday; 12.
	16. Dr. H. Thomson - -	*Glasgow* - -	Monday; 12.
	17. Mr. C. H. Roper - -	*Exeter* - -	Thursday; 3.
	18. Mr. R. W. Dunn - -	*Strand* - -	Thursday; 11.
	19. Mr. M. Brownfield -	Bromley, Middlesex.	Tuesday; 3.
	20. Mr. J. Broadbent - -	Ancoats - -	Wednesday; 2.
	21. Mr. W. Skinner - -	*Sheffield* - -	Tuesday; 3.
	22. Dr. A. C. Clarke - -	Salford - -	Thursday; 2.
	23. Mr. N. Miskin - -	Waterloo - -	Tuesday; 2.
	24. Mr. T. F. Morrish -	Toxteth Park -	Tuesday; 11.
Teachers of Vaccination, not supplying lymph -	Dr. W. Husband - -	*Edinburgh* -	Wednes., Sat.; 12.
	Dr. R. D. Tannahill -	*Glasgow* -	Mond., Thurs.; 12.

II.—Sources and Amount of Lymph Supply in 1875.

App. No. 3.
National Vaccine Establishment.

N.B.—The stations marked in *italics* are Educational Vaccinating Stations, authorised by the Local Government Board.

—	Vaccinating Stations.	Number of Vaccinations performed at the Stations respectively.		Number of Charges of Lymph supplied from the Stations respectively.	
		Primary.	Re-vaccinations.	Charged Ivory Points.	Charged Tubes each estimated as equal to 10 Ivory Points.
Vaccinators salaried from the Parliamentary grant.	1. *Surrey Chapel* - -	671	65	14,865	—
	2. Battle Bridge* - -	518	—	—	273
	3. *Tottenham Court Chapel*	1,000	28	†188	904
		2,189	93	15,053	1,177
Parochial and other Vaccinators not salaried from the Parliamentary grant, but contributing lymph at a fixed rate of payment.	1. *Manchester* - - -	1,340	6	—	819
	2–5. *Birmingham* - -	5,804	193	—	3,952
	6. *Bristol* - - -	825	23	—	47
	7. *Liverpool* - - -	1,077	—	—	1,956
	8. *Pimlico* - - -	483	5	—	1,202
	9. *Newcastle-on-Tyne* -	685	—	—	1,070
	10. *Westminster* - -	1,037	6	—	1,222
	11–12. *Marylebone* - -	1,671	4	—	907
	13. *Whitechapel* - -	1,102	2	—	482
	14. *Leeds* - - - -	1,272	—	—	540
	15. Coventry - - -	1,015	—	—	797
	16. *Glasgow* - - -	1,475	—	—	1,763
	17. *Exeter* - - -	544	2	—	197
	18. *Strand* - - -	456	2	—	457
	19. Bromley - - -	881	3	—	814
	20. Ancoats - - -	1,287	—	—	4,013
	21. *Sheffield* - - -	1,186	—	—	264
	22. Salford - - -	999	1	—	1,744
	23. Waterloo - - -	630	1	—	1,713
	24. Toxteth Park - -	1,144	2	—	2,155
	Total - -	24,913	250	—	26,114
	General Total -	27,102	343	15,053	27,291

* Discontinued in September 1875 on the death of Mr. G. L. Cooper.
† This number includes 32 charged glasses, each estimated as equal to four charged ivory points.

App. No. 3.

III.—Distribution of Lymph, 1875.

National Vaccine Establishment.

Number of applications:

From medical practitioners in England and Wales -	9,125
„ „ „ Ireland - - -	—
„ „ „ Scotland - - -	211
„ the Army - - - - - -	509
„ the Navy and from the Emigration Department -	68
„ Colonies - - - - - -	172
„ diplomatic and other foreign services - -	86
Total - - -	10,171

Supplies sent out:

Charged ivory points - - - - -	21,770
„ squares of glass - - - - -	32
„ capillary tubes - - - - -	21,892

No. 4.

ABSTRACT of MEDICAL INSPECTIONS made in 1875 with regard, generally, to the INCIDENCE OF DISEASE on particular places, and to consequent Questions concerning the LOCAL SANITARY ADMINISTRATION.

Area of Inquiry and Name of Inspector.	Ground of Inquiry.	Jurisdictions Concerned.	Chief Facts reported by the Inspector.
1. Alcester town - (Warwickshire.) Population, 2,363. *Dr. Ballard.*	Local request - -	Alcester rural sanitary authority.	Want of proper sewering and drainage. Surface nuisances. Polluted wells. Privies imperfectly constructed and badly managed. Certain dwellings dirty, dilapidated, and unfit for habitation.
2. Barton - on - Irwell Registration District. (Lancashire.) opulation, 51,571. *Dr. Stevens.*	Regis.-General's Return.	Barton urban sanitary authority.	High rate of mortality from zymotic diseases. Fever, diarrhœa, and scarlatina endemic. *Barton Urban Sanitary District.*— Watercourses much fouled by sewage; the Irwell especially is very offensive. Water supply insufficient and in some cases bad. Privies badly constructed, filthy, and productive of much nuisance. Houses unfit for habitation. Lodging-houses overcrowded and improperly conducted. No means of isolation or disinfection.
	" "	Stretford urban sanitary authority.	*Stretford Urban Sanitary District.*— Defective sewerage. Polluted wells. Defective arrangements for excrement disposal. Houses unfit for habitation. Scavenging arrangements defective. Nuisance from badly managed laundries which are situated in a very unhealthy locality. No means of isolating cases of infectious disease.
	" "	Swinton urban sanitary authority.	*Swinton Urban Sanitary District.*— Part of district undrained. Privy nuisances. Nuisances from pig keeping. Houses unfit for habitation. No means of isolating cases of infectious disease.
	" "	Barton rural sanitary authority.	*Barton Rural Sanitary District.*— General want of sewerage and drainage. Great scarcity of water. Polluted wells. Nuisance from overfull middensteads. Houses unfit for habitation No means of isolation or disinfection.
3. Chatteris - - (Cambridgeshire.) Population, 4,749. *Mr. Radcliffe.*	Regis.-General's Return.	Chatteris urban sanitary authority.	High rate of mortality from fever. Privy pits in a porous soil and not water-tight. Wells often close to privy pits, from which there is soakage into soil.
Cheshunt - - (Herts.) Population, 7,518. *Dr. Thorne.*	Regis.-General's Return.	Cheshunt urban sanitary authority.	Prevalence of low-type diseases. Sewerage and drainage either very defective, or wanting altogether. Privies dilapidated and productive of nuisance. Want of systematic arrangements for refuse removal. Wells exposed to excremental pollution. No means of isolation or disinfection.
5. Croydon - - (Surrey.) Population, 55,652. *Dr. Buchanan.*	Local request - -	Croydon urban sanitary authority.	Enteric fever prevalent during the year. Sewer infection, and questions of water pollution. Report subjoined.
6. Faversham Registration. Sub-district. Kent. Population, 11,595. *Mr. W. H. Power.*	Regis.-General's Return.	Faversham urban sanitary authority. Faversham rural sanitary authority.	High mortality from scarlet fever. In older parts of the town houses and outbuildings huddled together on insufficient areas. Dwellings often small, dilapidated, and insufficiently ventilated. Private wells liable to pollution. Parts of town unsewered. Sink openings not properly trapped. Sewers neither flushed nor ventilated. Defective arrangements for excrement removal. No means of isolation or disinfection.

Area of Inquiry and Name of Inspector.	Ground of Inquiry.	Jurisdictions Concerned.	Chief Facts reported by the Inspector.
7. Festiniog Registration. Sub-district. Population, 11,484. *Dr. Blaxall.*	Regis.-General's Return.	Festiniog rural sanitary authority.	Continued high rate of mortality from zymotic disease. Epidemic of scarlet fever. Dirty, ill-ventilated, and overcrowded dwellings. Schools attended by infected children. Accumulations of filth. Want of privy accommodation and proper drainage. Nuisances. Water supply exposed to pollution. No means of isolation or disinfection.
8. Great Yarmouth - (Norfolk and Suffolk.) Population, 44,500. *Dr. Airy.*	Regis.-General's Return.	Yarmouth urban sanitary authority. Mutford and Lothingland rural sanitary authority. East and West Flegg rural sanitary authority.	Continued prevalence of zymotic disease. Severe epidemic of scarlet fever. Houses so built as to render ventilation impossible. Scarlet fever very fatal in the "Rows." Houses on soil of unwholesome character. Sewers insufficiently ventilated. Privies badly constructed, and dangerously close to dwellings. Defective arrangements for excrement and refuse removal. Nuisance from slaughter-houses. Water supply partly obtained from polluted wells. Want of hospital accommodation.
9. Guisbrough Registration District, part of. (Yorks.) Population, 31,264. *Dr. Thorne.*	Regis.-General's Return	Guisbrough rural sanitary authority.	High general death rate. Much prevalence of scarlet and enteric fevers. *Coatham.*—Wells exposed to pollution. Sewers insufficiently ventilated. Nuisances from middensteads. *Saltburn-by-the-Sea.*—Sewers inefficiently ventilated. Nuisance from middensteads. *Other parts of Rural Sanitary District.*—Rows of houses built back to back, and, especially in *Brotton and Eston,* frequently in close proximity to noisome middensteads. Water supply partly derived from wells liable to pollution. Sewerage generally defective. Sewers unventilated. Badly constructed middenprivies in general use. Nuisances from middensteads and pigsties in part of district adjoining Redcar.
	,, ,,	Normanby urban sanitary authority.	*South Bank and Tees Tilery*—Sewers badly constructed and imperfectly ventilated. Midden privies are in general use and are productive of much nuisance.
		Do.; and Ormesby urban sanitary authority.	*Normanby and Ormesby.*—Enteric fever rarely absent. Water supply generally obtained from wells, many of which are exposed to pollutions. Frequent nuisances from midden privies. No means of isolation or disinfection.
	,, ,,	Redcar urban sanitary authority.	*Redcar.*—Some houses dirty, dilapidated, and unfit for habitation. Sewers insufficiently ventilated. Midden privies. Badly constructed and productive of serious nuisance.
	,, ,,	Skelton urban sanitary authority.	*Skelton.*—Sewerage in some places very defective. Midden privies in general use, and so constructed as to cause dangerous nuisance. Much nuisance from slaughter-houses.
10. Handsworth Urban Sanitary District. Population, 14,359. *Dr Ballard.*	Regis.-General's Return	Handsworth urban sanitary authority.	Confirmation of Report recently made by the local officer of health; viz.:—Waterclosets so situated as to favour escape of foul air into houses. Badly built cottages, without proper ventilation and in close proximity to privies and ashpits. Drainage very defective. Soil polluted by soakage from cesspools. Wells frequently close to middensteads.
11. Holywell Registration District. (Flint.) Population, 43,517. *Dr. Blaxall.*	Regis.-General's Return	- - - -	High general death-rate; and an exceedingly high death-rate from scarlet fever.
	,, ,,	Holywell rural sanitary authority.	*Holywell Rural Sanitary District.*—Epidemic of scarlet fever, and persistence of the disease. Infected and healthy children occupying the same bed. No measures adopted to prevent the spread of disease. Over-

Area of Inquiry and Name of Inspector.	Ground of Inquiry.	Jurisdictions Concerned.	Chief Facts reported by the Inspector.
Holywell Registration District—*cont.*	Regis.-General's Return	Holywell rural sanitary authority.	crowding. Ill-ventilated and dilapidated dwellings. Exposure of excrement in large open middensteads. Accumulations of refuse in the vicinity of dwellings. Very inadequate water supply, and exposure of water to contamination. No public drainage. Pig-keeping nuisances.
	„ „	Holywell urban sanitary authority.	*Holywell Urban Sanitary District.*—Epidemic of scarlet fever. Want of means for isolation and disinfection. Slaughter-houses in unwholesome relation to dwellings. Exposure of blood and offal, and also of refuse in the vicinity of houses. Very defective drainage. Privy nuisances. Dilapidated dwellings.
	„ „	Flint urban sanitary authority.	*Flint Urban Sanitary District.*—Severe epidemic of scarlet fever. Persistent presence of the disease, also of typhoid fever. Infected bodies occupying inhabited rooms. Exposure of infected persons. No measures adopted to prevent the spread of contagion. Overcrowding. Beds occupied night and day. Dilapidated dwellings. Common lodging-houses (not registered) both dilapidated and overcrowded. Slaughter-houses not registered. Exposure of blood, offal, and other filth in the vicinity of dwellings. Insufficient water supply. Sewers not ventilated. Privy nuisances.
	„ „	Mold urban sanitary authority.	*Mold Urban Sanitary District.*—Persistent presence of typhoid fever. High death-rate from zymotic disease. No provision made for isolation nor disinfection. Very defective drainage. Unwholesome disposal of sewage. Inadequate water supply. Exposure of wells to contamination. Privy nuisances. Pigs kept too near dwellings, Dwellings dilapidated.
12. Keighley and Oakworth. (Yorks.) Population, 28,059. *Dr. Stevens.*	Regis.-General's Returns	Keighley urban sanitary authority.	*Keighley Urban Sanitary District.*—Watercourse polluted. Defective drainage. Insufficient supply of water. Trade and pig-keeping nuisances. Defective arrangements for excrement and refuse removal. Unwholesome dwellings. Overcrowding. Common lodging-houses ill-regulated.
	„ „	Keighley rural sanitary authority.	*Keighley Rural Sanitary District.*—Water supply liable to contamination. Defective drainage. Accumulations of excrement and refuse.
	„ „	Oakworth urban sanitary authority.	*Oakworth Urban Sanitary District.*—Defective drainage. Water supply insufficient and liable to contamination. Accumulations of excrement and refuse. Pig-keeping nuisances. Unwholesome dwellings. Polluted open streams.
13. Lenton - - (Notts.) Population, 6,315. *Dr. Thorne.*	Report from Medical Officer of Health.	Lenton urban sanitary authority.	Middensteads in general use; some of which contain enormous accumulations of excrement and refuse. No systematic arrangement for the removal of their contents. Water-closets badly constructed and productive of nuisance.
14. Norfolk and Norwich Hospital. *Mr. Radcliffe.*	Request from governing body.	Special - -	Recent fatal prevalence of pyæmia and erysipelas. Demands upon the hospital have outgrown its accommodation. Means wanted for isolating traumatic infections. Wards insufficiently ventilated. Drainage arrangements faulty. Various structural improvements, and systematic sanitary supervision, wanted.
15. Northampton General Lunatic Asylum. *Dr. Buchanan.*	Request from Medical Superintendent.	Special - -	Extensive outbreak of enteric fever. Its extension apparently due to the defective state of the drains of the asylum.

Area of Inquiry and Name of Inspector.	Ground of Inquiry.	Jurisdictions Concerned.	Chief Facts reported by the Inspector.
16. Oldbury Registration Sub-district. (Worcestershire.) Population, 17,636. *Dr. Ballard.*	Regis.-General's Returns	Oldbury urban sanitary authority.	*Oldbury Urban District.*—Death-rate increasing year by year. Prevalence of zymotic diseases. Little or nothing has been done to carry out the recommendations made by Dr. Thorne on previous inspection in 1871. Absence of any proper drainage. Nuisance from accumulations of slops and sewage. Brook course an open sewer and productive of much nuisance. Privies dilapidated and overfull. No proper system for removal of excrement and refuse. Dwellings dirty, damp, dilapidated, and unfit for habitation. Scarcity of house accommodation. Smoke nuisance.
	,, ,,	West Bromwich rural sanitary authority.	*Oldbury Rural District.* — Cottages undrained. Accumulations of sewage in neighbourhood of wells and houses.
17. Oldham Registration District, parts of: viz.,— The Rural Sanitary District. (Population, 2,467.) Royton Urban Sanitary District. (Lancashire.) (Population, 7,794.) *Dr. Stevens.*	Regis.-General's Return	Oldham rural sanitary authority.	*Oldham.* — Drainage very defective. Water supply insufficient. Wells exposed to pollution. No systematic arrangements for removal of excrement and refuse. Dwellings insufficiently ventilated.
	,, ,,	Royton urban sanitary authority.	*Royton.* Epidemic of enteric fever. System of sewerage defective. Sewers unventilated. Privies dilapidated and overfull. Soil and air polluted by overflowing cesspools. No system of scavenging. Houses badly built, insufficiently ventilated, and out of repair. Overcrowding. Enormous masses of excrement deposited in the neighbourhood by the Carbon Fertilizing Company.
18. Pontefract Registration Sub-district, part of. (Yorks.) (Population, about 2,300.) *Dr. Beard.*	Regis.-General's Return	Pontefract rural sanitary authority.	*South Featherstone.* — Enteric fever constantly prevalent. Back to back houses in course of erection. Building not controlled by sanitary authority. Houses being built on arches over stream which receives sewage. Overcrowding, No means of isolating cases of infectious disease. Cesspools not watertight. Houses generally undrained. Water supply exposed to pollution by soakage from cesspools.
	, ,,		*Street houses.*—Prevalence of enteric fever. Water supply exposed to pollution by soakage from cesspools.
19. Potterspury Registration District. (Northamptonshire.) Population, 11,717. *Dr. Thorne.*	Regis.-General's Returns	Potterspury rural sanitary authority.	Prevalence of enteric fever.
	,, ,,		*Paulerspury.*—Wells polluted by surface soakage. Defective drainage. Nuisances.
			Stony Stratford.—No system of drainage. Water supply obtained from wells sunk in gravel and exposed to pollution from cesspool soakage.
	,, ,,		*Wolverton.*—Water supply exposed to risk of pollution by suction of foul matters from closet pans into mains of an intermittent service. Unventilated sewers. Passage of sewer air into dwellings. Nuisance at sewage outfalls. Offensive middens.
	,, ,,		*Wolverton End.*—Parts of the hamlet extremely filthy. Soil sodden with water and liquid filth. Much nuisance.
20. Ramsay Registration Sub-district. (Hunts.) Population, 5,449. *Dr. Airy.*	Regis.-General's Returns	Huntingdon rural sanitary authority. Ramsay urban sanitary authority.	Prevalence of zymotic disease, especially of enteric fever. Cottages old and dilapidated, and rendered damp by want of proper eaves-guttering, and spouting. Canal rendered offensive by inflow of sewage. Sewers insufficiently provided with ventilation and means for flushing. No regular system of excrement removal. Nuisance from pig keeping. No hospital accommodation.

Area of Inquiry and Name of Inspector.	Ground of Inquiry.	Jurisdictions Concerned.	Chief Facts reported by the Inspector.
21. South Kensington, —one household and its associations. *Dr. Buchanan.*	Personal information -	Private - -	Outbreak of scarlatina among a number of persons (family and guests) who had fed at the same house; and who, it appeared, might there have consumed an infected article of food. Report subjoined.
22. Swansea Rural Sanitary District, part of. (Glamorgan.) *Mr. Radcliffe.*	Request from local authority.	Swansea rural sanitary authority.	Enteric fever endemic. Overcrowding. Want of ventilation of houses, and especially of the bedrooms. Absence of privy accommodation. Water supply exposed to excremental pollution. Want of drainage in vicinity of houses.
23. West Riding House of Correction. (Wakefield.) *Dr. Ballard.*	Request from Home Office.	Special - -	Prevalence of enteric fever preceded and accompanied by diarrhœa. Interior of prison polluted by sewer air in consequence of faulty construction of sewers and drains. Infection probably spread by the use of infected earth supplied to earth-closets.
24. Wednesbury Registration Sub-district. (Staffordshire.) Population, 25,030. *Dr. Ballard.*	Regis.-General's Returns	Wednesbury urban sanitary authority.	High general death-rate, and high mortality from zymotic disease. No proper sewering and drainage. In some parts wells either polluted or water supply wanting altogether. Unwholesome cottages. Close, unwholesome, undrained courts. Insufficient dealing with infectious diseases.
25. Wells Registration Sub-district. (Norfolk.) Population, 6,473. *Mr. W. H. Power.*	Regis.-General's Return	Walsingham rural sanitary authority.	Outbreak of diphtheria, the origin of which is obscure. Want of proper sewerage and drainage. Great scarcity of drinking water in dry seasons. Dwellings insufficiently ventilated. Medical officer of health not furnished with proper information. No proper inspection of nuisances. No means of isolating cases of infectious diseases.
26. West Bromwich - (Staffordshire.) Population, 41,795. *Dr. Ballard.*	Regis.-General's Return	West Bromwich urban sanitary authority.	High general rate of mortality. Prevalence of zymotic diseases. District generally unsewered. Large accumulations of excrement and refuse. Scavenging arrangements defective. Polluted wells. Scarcity of drinking water in some places. Damp and dilapidated houses. Scarcity of small houses. Overcrowding. No hospital accommodation for cases of infectious disease.
27. Wiveliscombe - (Somerset.) Population, 2,059. *Dr. Blaxall.*	Regis.-General's Returns	Wiveliscombe urban sanitary authority.	Prevalence of fever. Many dwellings unfit for habitation. Accumulations of refuse. Pig nuisances. Insufficient privy accommodation. Defective sewerage and drainage. Water supply exposed to pollution.

App. No. 5.

On Enteric Fever at Croydon, by Dr. Buchanan.

No. 5.

Report on an Epidemic of Enteric Fever at Croydon in 1875, by Dr. Buchanan.

Croydon population.

Croydon parish, the area over which the Croydon Local Board of Health has sanitary jurisdiction, forms a part of the Croydon sub-district of the Croydon Registration district. The population-statistics of the various parts of the Registration district are as follows :—

Registration District, Sub-District, Parish, or Place.	Area in Acres.	1861.		1871.		1875.
		Inhabited Houses.	Population.	Inhabited Houses.	Population.	Estimated Population.
Croydon District	32,548	8,073	46,474	14,525	83,853	93,881
Croydon sub-district	20,851	6,309	37,093	12,254	71,319	81,020
Mitcham sub-district	11,697	1,764	9,381	2,271	12,534	12,861
In Croydon sub-district.						
Croydon parish -	9,901	5,338	30,249	9,873	55,652	63,000
Penge hamlet -	770	668	5,015	1,956	13,202	15,500
Coulsdon parish -	4,314	140	993	250	1,591	1,620
Addington „ -	3,605	122	639	121	607	630
Sanderstead,, -	2,261	41	206	54	267	270

Births and Deaths.

In Croydon sub-district during recent years, the births, and the deaths from all causes and from various epidemic diseases, are thus given by the Registrar General :—

Year and Quarter.	Births.	Deaths, all Ages.		Deaths 0-1.	Deaths, all Ages, from							In Public Institutions.
		Previous average.	In quarter.		Small-pox.	Measles.	Scarlet Fever.	Diphtheria.	Hooping Cough.	Fever.	Diarrhœa.	
1870 - i	658	307	370	65	—	4	38	—	3	6	2	30
ii	602	290	308	75	1	3	11	1	17	7	4	45
iii	608	310	319	105	2	4	21	—	6	8	43	41
iv	585	294	313	92	8	7	22	2	10	7	8	41
1871 - i	641	331	389	95	32	16	19	—	9	7	1	48
ii	582	312	317	90	30	4	9	—	10	9	16	60
iii	591	339	337	113	7	2	5	1	5	5	48	46
iv	582	309	293	85	—	4	3	—	4	9	11	35
1872 - i	687	360	339	89	3	19	4	3	9	9	6	44
ii	604	309	281	59	—	27	—	1	11	7	—	43
iii	598	333	339	118	1	1	3	—	19	5	32	50
iv	603	310	279	70	—	7	2	2	14	4	4	33
1873 - i	670	366	317	73	5	1	—	3	5	7	6	48
ii	618	302	315	77	—	—	—	1	8	4	1	45
iii	628	332	279	89	—	—	—	3	3	1	44	28
iv	652	296	307	73	—	11	2	1	—	3	7	36

Year and Quarter.	Births.	Deaths, All Ages. Previous average.	Deaths, All Ages. In quarter.	Deaths, 0-1.	Deaths, all Ages, from. Small-pox.	Measles.	Scarlet Fever.	Diphtheria.	Hooping Cough.	Fever.	Diarrhœa.	In Public Institutions.
1874 - i	642	348	337	76	—	15	2	3	7	7	—	34
ii	660	305	330	62	—	44	—	1	7	8	3	42
iii	620	319	303	105	—	12	4	1	8	4	29	35
iv	628	294	357	87	—	1	6	2	11	—	10	44
1875 - i	670	331	448	93	—	—	8	1	12	8	3	62
ii	671	309	379	78	1	—	2	1	13	32	11	43
iii	655	307	359	106	—	—	5	2	15	17	30	46
iv	683	314	437	103	—	—	33	4	11	44	15	48

Fever mortality, 1875.

The registered mortality from fever in 1875 has required certain corrections, on account of persons dying in public institutions, and on other grounds. After such corrections, the fever deaths are found to have been distributed in the two sub-districts respectively as follows :—

In Mitcham sub-district—

4 deaths, being at the rate of 0·32 per 1,000 inhabitants.

In Croydon sub-district—

100 deaths, „ „ 1·24 „ „

Again, within *Croydon sub-district* the distribution was—

In Croydon parish :

90 deaths, being at the rate of 1·42 per 1,000 inhabitants.

In Penge hamlet :

8 deaths, „ „ 0·52 „ „

In Coulsdon parish :

2 deaths, „ „ 1·24 „ „

In other parishes :

0 deaths, „ „ 0·00 „ „

In Croydon parish, the 90 fever deaths occurred in the several months of the year thus :—

Jan.	0	April -	14	July -	3	Oct. -	15
Feb. -	1	May -	10	Aug. -	4	Nov. -	19
March -	4	June -	7	Sept. -	5	Dec. -	8

Attacks of fever, 1875.

It is in view of such statistics as the above, relating only to mortality, that inquiries of the present sort usually have to proceed. But at Croydon the advantage has been gained of records of fever-sickness, non-fatal as well as fatal. First to the Medical Officer of Health, and afterwards to myself, the medical practitioners of Croydon and its neighbourhood have furnished, at great cost of time and trouble to themselves, a mass of information as to the places and times of fever occurrence. The facts thus given are from their nature of incomparably greater value than those derived from the records of mere deaths, and they have been given with so much completeness that they can be used for investigating the distribution of the fever for the purposes of this report.

Their distribution in Croydon district.

The brunt of the fever-incidence on Croydon district in 1875 has been, as the mortality tables have already shown, upon the parish of Croydon itself. There was a local, but somewhat sustained, epidemic at Penge, apparently not related in any way to the Croydon outbreak. In other

parishes of the Croydon sub-district, and in the Mitcham sub-district, there has been no amount of fever prevalence that can be called an epidemic.

In Croydon parish.

For Croydon parish, the area of the Local Board of Health, 1,164 cases of fever appear on the returns of medical men as having been attended by them in 1875. The returns (owing to the mode of their collection) are not so complete for the months of May to August as for other periods; but they are so nearly perfect that the total number of cases occurring in the parish during the year may be stated to have been about 1,200.

Nature of fever.

The fever has been essentially enteric or "typhoid" fever, with a largish sprinkling of cases of that indefinite complaint which is named "simple continued fever," or else "febricula." In the returns 104 cases are spoken of under some such name. These are included in the 1,164 cases. No case of typhus fever was heard of in the year.

"Febricula," and the like, have been included with the prevalent enteric fever upon a balance of medical considerations, into which it is not necessary here to enter. The inclusion of such cases does not affect the general statements of this report, and when it affects particular statements, the fact will be noted.

Ninety deaths in about 1,200 attacks is about one death to 13 attacks, a mortality about that which is usual when enteric fever occurs in a community of average ages.

Houses attacked.

The 1,164 cases occurred in 959 houses. As there are now 11,526 houses in the parish of Croydon, it follows that 83 per 1,000 houses have been invaded by the disease. Two hundred and five cases were returned from houses that had been already invaded. Apart from public institutions and schools, there were examples of particular houses having in them, not two only, but three, four, five, or six attacks of fever. In most of the study that has been given to the distribution of sickness, the invasion of the house had been regarded as more important than the recurrence of disease in a house, and most of the statements that follow will have reference to houses rather than to individual patients.

Times of attack.

Local medical opinion differs about the existence of enteric fever habitually in Croydon. In view of the death statistics given above, and of the necessarily greater value of positive than of negative opinion on the point, I cannot but think that the disease is seldom wholly absent. It is certain, however, that in the last quarter of 1874 there was very little of it. In that quarter there was no death from any kind of fever.

The 959 houses in Croydon parish that were attacked with fever in 1875, were first attacked in the following months:—

Jan. -	15	April -	186	July* -	18	Oct. -	275
Feb. -	53	May* -	39	Aug.* -	32	Nov. -	92
March -	79	June* -	30	Sept. -	69	Dec. -	71

An asterisk* is here put against the names of those months for which the returns are known to be less complete.

Many houses had in them cases of "febricula" as well of enteric fever. They are dated here according to the first attack of any fever. The largest proportion of such minor disease was in January, when six houses had in them cases of "simple continued fever" or "febricula." For the rest, most of the cases thus named appear in the returns of the last four months of the year.

The above table teaches that enteric fever existed to only a small extent in January, but began to assume epidemic proportions in February. It increased somewhat in March, and became a wide epidemic in April. Subsiding for three or four months and re-assuming epidemic activity in September, its outbreak in October surpassed that of the spring, and it continued abundantly prevalent to the end of the year. In the earlier half of the year fever attacked 402

houses, or 35 per 1,000 houses in the parish; in the latter half of the year it newly attacked 557 houses, or 48 per 1,000 houses.

These are the broad facts, themselves for the most part elicited during the inquiry itself, of the epidemic of which I am instructed to investigate the causes. Other facts concerning the local distribution of the epidemic will come under consideration in connexion with questions of causation.

Means of fever-spread.

There is before the Department and the medical profession a vast mass of evidence to the effect that enteric fever habitually spreads through a community by means of the bowel discharges of the sick; something from those discharges finding its way either into the air which people breathe, or into the water or food which they consume. This report will consist essentially in the application of this experience to Croydon, and it will not be concerned with the introduction or other "origin" of the fever.

Croydon sewer systems.

The greater part of the excrement of Croydon parish is discharged into sewers. Of these sewers, the larger number, serving 9,051 houses, converge to an outfall at Beddington, where the sewage is used in irrigation. To the east of the parish other sewers, serving 1,405 houses, converge to the South Norwood sewage farm. These are the distinctively Croydon sewer systems. At the extreme north of the parish 506 houses drain into the Effra sewer system. There remains 564 houses, a few in central parts, but the great majority in the more distant parts of the parish, which have their private drainage arrangements, generally by cesspools, but a few by irrigation within their own precincts.

Distribution of fever.

The distribution of Croydon fever in 1875, in its relation to the sewer systems of the town, has been as follows:—In the houses draining to the Effra sewers, only three cases of fever have been heard of. The houses which have cesspools or private drainage arrangements of their own, are only known to have had six cases of fever in them. The two systems of distinctively Croydon sewers are those on which the fever has mainly fallen. It has not, however, affected them both in the same degree. In the subjoined tabular statement are shown the facts of fever incidence on the houses of the parish, according as the houses are one or the other sewer system.

Sewer System.	Number of Houses.	Number attacked by Fever.	Per 1,000 Houses.	Number with Deaths from Fever.	Per 1,000 Houses.
On Beddington system -	9,051	905	100	83	9·2
On South Norwood system -	1,405	45	32	4	2·8
Not on either system -	1,070	9	8	3	2·8
Parish - -	11,526	959	83	90	7·8

Central incidence.

Within each of the two systems there have been local differences of fever prevalence; and there have also been some broad differences that may be generally stated. The circumferential parts of the parish have suffered less than the central parts on the same sewer system. Thus, Thornton Heath draining to Beddington by a sub-system largely distinct from the general sewer system, has had comparatively little fever. The parts to the north and east of Norwood Junction Station, draining to South Norwood, have almost wholly escaped, but in this direction local outbreaks have pushed out the boundary line of the epidemic. The

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hamlet of Shirley, at the end of another branch of the South Norwood sewers, has also had scarcely any fever. At the south end of the parish about Croham Road, there has been but little of it.

Incidence on high levels.

Houses, to whatever system sewered, situated at the higher levels of the town, have had more fever than those on the lower levels. This accords with general experience in like cases, and is partly, but probably only partly, to be connected with the greater frequency of inside drain communications in better class houses, which commonly find themselves on the higher levels.

On the respective sewer systems.

Cases of fever occurred first on the Beddington sewer system, which was pretty widely, if not intensely, infected before 1875 began. It was not till February 7th that any case is known to have occurred in the houses of the South Norwood system.

The subsequent monthly incidence of the fever on the houses of the Beddington (B.) and South Norwood (S. N.) systems is shown below.

	B.	S. N.		B.	S. N.		B.	S. N.		B.	S. N.
Jan.	15	0	April	176	9	July	18	0	Oct.	159	15
Feb.	48	4	May	34	4	Aug.	32	0	Nov.	83	6
Mar.	74	5	June	30	0	Sept.	68	1	Dec.	68	1

Arrangements of sewers: their size.

The original sewer system of Croydon, constructed in 1851 and following years, was altogether of pipe, and served for excrement, slop-water, and roof-water only. The pipes were of small calibre, nine inches being a common diameter for principal sewers, and six inches and four inches for sub-sewers. Experience showed numerous stoppages occurring in these very small sewers, and as the town grew few public sewers were made of smaller diameter than nine inches, and the smaller sewers of the central parts were from time to time replaced by larger pipes. On the South Norwood system, of altogether more recent formation, no sewer is less than nine inches diameter. Some main sewers and the two chief outfall sewers are now of brick, of a diameter of 24 inches and upwards. In many parts of the town the sewers are on the "back system;" in other parts they run under the public roadway. In the original arrangement of 1851, special provision

Their relation to ground-water and rain.

was made, by means of the Bourne culvert, for keeping the ground-water down to a lower level than previously, and for thus preventing flooding of the lower parts of the town. It was intended that no ground-water or rain water (other than from roofs) should enter the pipe sewers. For some years, too, the pipe sewers received very little surface water, but by degrees it became a not infrequent practice to send into them the drainage of roads. The result was at times to overcharge the smaller pipes, and fresh arrangements have within the last year or two been made for the separate disposal of such surface water as had before been sent to the

Gradients, ventilation, flushing.

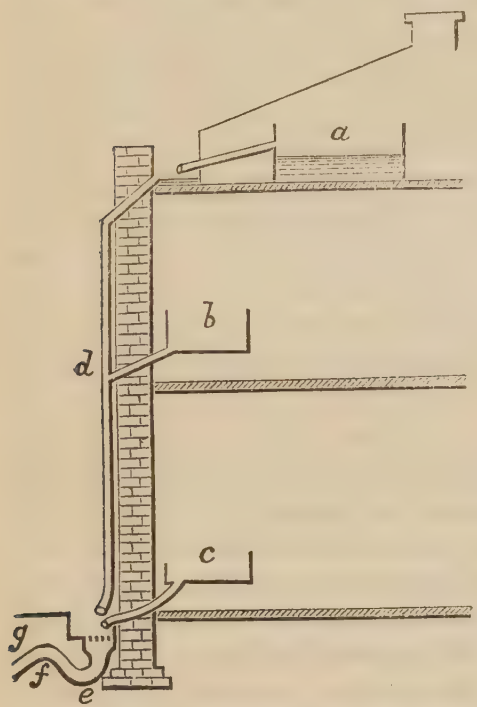
pipe sewers. In some parts of the town the sewers have a very slight incline; in other parts they are very steep. Means of ventilating the public sewers have, since 1854, been provided by shafts in the roadway. The contrivance introduced for flushing the sewers consists of a junction between the water main and the sewer, allowing a considerable quantity of water to be discharged into the sewer upon opening a sluice-cock.

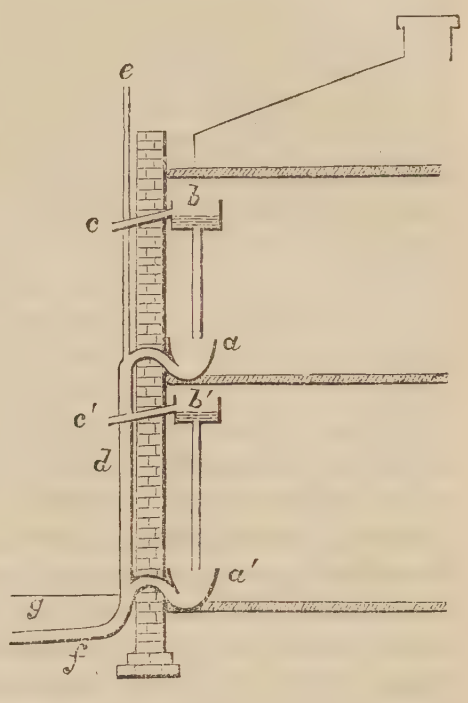
House drainage.

The drainage of houses in Croydon is by 4 and 6-inch pipes in uninterrupted communication with the public sewers. In a very few houses only is there any trap in the horizontal part of the house-drain. Of late years great attention has been given to "disconnecting" sinks, cistern wastes, and bath discharges, and there are many houses where all pipes from such places pass through the outer wall and end at the outside over a trapped

grating leading to the sewer. The watercloset pipes in such houses are habitually more or less ventilated by means of special pipes carried up the house beyond the roof. These serve also to some small extent to give additional ventilation to the public sewers.

The present idea of Croydon house drainage is therefore somewhat according to the following diagrams, of which No. I. shows the pipes disposing of slop and waste, and II. shows the pipes connected with the waterclosets of the house :—





I. *a*. Roof cistern (rarely present).
b. Upstairs sink (bath would be similarly provided).
c. Scullery sink.
d. Rainpipe.
e. Trapping bend under outside grating.

II. *aa'*. Waterclosets.
bb'. Water-waste preventers for closet supply.
cc'. Overflows from same, going into the open.
d. Soilpipe, here shown outside ; an approved arrangement.
e. Ventilation pipe.

I. & II. *f*. Junction of slop and soil drains directly continuing to the public sewer.
g. Ground level.

Of course all houses have not these arrangements, and notably the older parts of the town show many departures from what is regarded as the proper system.

Efficiency of sewers.

The efficiency of the system of public sewerage for the complete and rapid removal of excrement seems at first view to be considerable. There is certainly not at Croydon that universal disintegration and decomposition that goes on in the large brick sewers of other towns, for at the Croydon outfalls paper and shaped fæces may be observed among the matters brought down in the sewers. But a very little further examination shows that there are many local defects, and some important general defects, in the Croydon arrangements. Many of the older town sewers remain, some being admittedly unequal to the demands made on them by the growth of the town. In the lower-lying, flatter parts of the town, some sewers are known to be in bad order and to be incapable of being kept clean. The flushing arrangements are not such as to allow of any sewer being thoroughly washed in its whole interior ; a 4-inch water stream for example only serves to fill one-fourteenth part of the area of a 15-inch sewer pipe, and can only wash a quarter of its interior circumference. Nor are the public sewers adequately ventilated. Intervals of 120–250 yards may be found between the ventilating shafts in a roadway, such shafts having covers that much reduce this available opening, and being in addition often blocked by trays of charcoal. The

Church Road outfall sewer has no ventilator between a point just at its end, and a point (in the town) half a mile before its end. If this outfall sewer should ever run full, the air in the Church Road sewer would certainly be very dangerously confined.

Efficiency of house drains.

The efficiency of the drainage arrangements of particular houses in Croydon, is, also, at first sight, considerable ; as was to be expected in a town where a really large proportion of the residents take an interest in sanitary matters. Grosser drain-defects, such as untrapped drains, bath and sink wastes going directly into sewers, and drains leaking about the basements of houses are, it is true, sometimes met with both in good-class houses and in houses of the poorer class. But the drainage defects in good-class houses are commonly of a less obvious kind than these, consisting of hidden cracks in pipes, overflow pipes going into soil pipes, ventilation pipes zigzagged so as to prevent any air current through them, or opening near to some window. In poorer houses, where all closets are outside and all sinks disconnected, the closet drain is sometimes found to have a fracture in it, or the outside gully to be untrapped.

Relation of sewer and drain defects to fever.

In the course of my inquiry I examined a large number of houses—of course not a large proportion of the whole, but in a variety of respects typical of the whole—including many where there had been no fever, as well as those where there had been fever, among the latter a probably large proportion where the circumstances of fever production had been most obscure; and I satisfied myself that in a very considerable majority of the Croydon houses that have had fever, drain air charged with infection from the common sewers of the town had had the opportunity of entering the houses. Oftentimes in a group of houses, resembling each other in their general sanitary arrangements, some particular drain defect was discoverable in certain houses but not in others ; and as often it was found that the incidence of the fever had been upon those which showed that drain defect and not upon the houses which did not show it.

I quote from among other instances two examples of such differentiation. They were cases of a less common kind, where the relation of the fever to the particular defect had not been at once obvious.

(1.) There had been fever at some houses in St. Peter's Street, with no inside drains whatever, with outside watercloseets and disconnected scullery sinks. The first seven of them were visited, and it was found that the drain just outside the house was at four of them practically untrapped, but was efficiently trapped at the other three. In none of the latter had there been fever, but this disease was present last year in three out of the four former. (2.) Howard and Birchanger Roads, South Norwood, were visited because of a different prevalence of fever in the two. Thirteen houses in the former road, including seven that had had fever, were examined, and eight houses in the latter, including one of two that had had fever. Few of the houses were found with their drainage arrangements conforming in all respects to the standard ; but one particular defect characterised the great majority of those where there had been fever. This was an overflow pipe going direct into the sewer from a cistern that was usually placed in a very confined situation under a bedroom floor. In the Howard road this arrangement was seen in eight houses, the cistern furnishing more or less of the drinking-water in the case of seven of them, and in six out of these seven there had been fever. It was not seen in the five other houses, only one of which (having a stinking watercloset) had had fever. In the Birchanger Road this particular defect was witnessed in two houses only out of the eight visited, and one of the two had had a case of fever; the houses where there was no such arrangement had escaped. [Facts as to the second fever house were not obtainable.]

Other ways, less direct than the foregoing, by which excremental products bearing with them the contagium of enteric fever have produced the disease, will immediately come under review. But there can, I think, be no doubt that the chief way in which enteric fever spread last year in Croydon was the most direct and commonplace way of all, viz., by the escape of infected air from the sewers and its inhalation by persons susceptible of the disease.

Intensity of outbreak.

The great intensity and simultaneousness of the fever epidemic over Croydon should be no hindrance to the acceptance of this view. Where sewers are small and ill ventilated they constitute perfectly sufficient means for the rapid distribution of fever infection ; and places having such sewers may not only show fever rates maintained as high as before the sewers were made, but they may show as smart outbursts of fever as are witnessed where conveyance through water or milk is in question. Croydon itself, after it had made its sewers and before it attempted to ventilate them, had this experience. So in other instances that have come under my personal knowledge, fever has maintained itself after pipe sewers, ill ventilated, had been laid : as in Rugby, in Carlisle, in Chelmsford, in Penzance, in Worthing ; in the last two places breaking out in severe, sudden, and diffused epidemics without there being any question of other distribution than by sewers. And my personal experience is confirmed by that of others. Towns with larger sewers have not appeared to have the same suddenness of outbreak when spread by means of sewer air has been in question. In them the evil influence of sewer infection is more gradually manifested, as might be expected from the different physical circumstances of the two kinds of sewers.

The intention of small sewers, as opposed to large ones, is that their contents shall flow away with great rapidity, leaving the sewer clean and free from deposit. So far as small sewers fail to fulfil this intention, they have certain disadvantages of their own. To some extent when sewers are running freely, but greatly more when they are not running freely, displacement of air from them is an affair of sewer calibre. If a 6-inch sewer be not running well, and a pail of water be thrown into it, that water will occupy 16 times the space, relatively to the sewer diameter, that it would occupy in a 2-feet sewer ; displacement of air in the smaller sewer will be relatively 16 times as great, and the displacement will be greatly more sudden. Hence the air in a small sewer is liable to be under far greater pressure than the air of a large sewer. To afford a safe exit to displaced and compressed sewer air is one (the more popularly understood) object of sewer ventilation ; and it is plain that means of such ventilation are wanted more numerously in proportion as the displacements of air may be local and sudden. For any want of perfect freedom of current and lack of proper exit-means for displaced air *tells for more* in small than in large sewers.

But at least as important a further object to be attained by the ventilation of sewers, is such dilution of sewer air as shall reduce to the utmost its harmful qualities. These harmful qualities are popularly measured by smell, and if there be no sewer-smell people think little of danger from a sewer. The popular view may be true enough of such minor harm as may come from ordinary excrement decomposition ; but it is certainly not true of such greater harm as comes from the specific infection of a sewer. Croydon itself has given some of the experience upon which this judgment is founded. In those of its former fever epidemics which could be indisputably associated with escape of sewer air into houses, the offensiveness of the sewer air has not been great, nothing nearly so great as at many a harmless street gully in London. It has even happened at Croydon and elsewhere that noise and not smell has been the means by which the escape of infected sewer air has been recognised. And increasing knowledge of the nature of fever has made it pretty certain that the material of contagion is a substance itself without odour, and perhaps less likely to be active in excrement that has passed into fœtid decomposition.

Thorough ventilation, then, for the purpose of diluting and as far as

possible nullifying the infection that infective sewage exhales, is wanted equally whether the sewer stinks or does not stink. Want of due distinction between stink and infectiveness has led to this consideration being overlooked in practice; and it has repeatedly happened that the air of small sewers has possessed (to judge by results) an infectiveness more intense than the air of more offensive large sewers. The air in a 9-inch pipe, with petty openings at every 150–250 yards, and no other openings, except the soil pipes of houses, is liable, it appears to me, to contain in a very concentrated form the poison of enteric fever, if excrement from fever patients be discharged into the pipe anywhere in the neighbourhood.

Sewer-air "laid on" to houses.

While I admit that for the most part the sewers of Croydon are well adapted for the removal of liquids and solids, they appear to me to be adapted, when infected by fever excrement, to facilitate the passage of infection into the vicinity of houses. The air of the sewers is, as it were, "laid on" to houses; it is arranged that every house drain and every house soil pipe shall contain, up to the very wall of the house and up to the very trap of the watercloset, the common air of the Croydon sewers, not simply charged with impurities it may receive from the particular house, but charged also with any dangerous quality that it may have brought from other houses; for hardly anywhere in Croydon can there be found an arrangement for severing the sewer air from the air of the house drain. So that, wherever drain air has entered a house, no matter by how inconspicuous a defect, and no matter whether it has given rise to stink or not, it has been the air of the common sewer, and this was throughout 1875 charged to an intense degree with the infection of enteric fever.

It were to be wished that, at this point, before passing to consideration of other ways by which enteric fever may have spread in Croydon, some kind of estimate could be formed of the extent to which its spread has been in the commonplace direct way that has heretofore been considered. This is not, however, possible, for two reasons; first, that if sewer infection have been so intense yet so inappreciable by the senses as it doubtless has been, many persons besides those who received it through discoverable house defects must have become exposed to it; secondly, and conversely, that it cannot certainly be affirmed in regard of those persons who had the opportunity of breathing infected air, that there was no other way in which infection was presented to them. It will be needful to put out the whole history before attempting to affirm the shares that various conditions have had in producing the epidemic.

Other means of fever-spread.

There now arise for consideration other methods, by which the material of enteric fever may have been distributed among the population of Croydon, namely, by means of milk or of water.

By milk?

Suggestion that fever may have been spread by means of milk has come essentially from those who doubt the wholesomeness of sewage-farm milk, and of milk from cows fed on sewage produce. Inquiry as to the milk supply of fever-infected houses, first by the medical officer of health, and afterwards independently by myself, has, however, shown no ground for suspecting that milk has played any part in the epidemic.

To the houses which I myself visited the milk supply had been furnished not by one or two, but by 18 milkmen, and there was no special incidence of fever on the customers of any one of them. Of the 18 milkmen, some got milk or fodder from the sewage farm, others got none. There was some difference of fever incidence on the customers

of the two classes, a difference probably unimportant as the inquiry was not on a large scale, but the direction of the difference was in favour of the customers of those milkmen who had dealings with the farm.

By water?

As regards influence of water, there is reason to believe that polluted water has played some part in the phenomena of the epidemic. A very large part of the time that has been spent on this inquiry has been taken up with endeavours to understand the extent to which water can have operated to spread infection, and the method of such operation. The facts and conclusions will, however, be reported as briefly as possible.

The primâ facie case against water as an element in the production of fever is as follows :—

1. Impurities are known to have entered the wells and reservoirs.
2. Impure water has been known to be drawn from house taps.
3. The area supplied by Croydon water has had much more fever than other areas of the parish, thus :—

Water System.	Number of Houses.	Number attacked by Fever.	Per 1,000 Houses.	Number with Deaths from Fever.	Per 1,000 Houses.
On Croydon* system	9,039	942	104	83	9·1
Not on Croydon system -	2,487	17	7	7	2·8
Parish -	11,526	959	83	90	7·8

4. In the South Norwood neighbourhood there have been local outbursts of fever just within the Croydon water area, and no such outbursts beyond that area.

5. Within the town, some cases of fever have occurred in houses served by Croydon water, though the drainage arrangements of the houses appeared perfect, and in some houses though the drainage was disposed of independently altogether of Croydon sewers.

Impurity in wells.

Referring for an account of the principal impurities that have obtained access to the Croydon wells to a memorandum (appended Note B.) which I have already written on the circumstances of those wells, I observe that any minor sources of impurities in the water of the wells, beyond those there described, have been wholly unimportant in the present relation. As regards any influence upon the production of fever of the impurities reported in the appended paper it has to be noted, first, concerning their amount, that the whole population of Croydon parish, each person drinking a gallon of water daily, would not in four years have got through one grain of the "albumenoid ammonia," which had been contributed to the town water supply from the topmost thirty feet of gravel and chalk ; secondly, concerning their origin, that the sources of impurity were certainly local and all of them pretty certainly known ; and thirdly, as to their nature, that none of the ascertained sources of impurity are suspected of having been infected with the material of enteric fever. I judge, therefore, that there is no evidence of the well water having been a vehicle of fever contagium.

* With the houses on the Croydon water system are included 240 within the water area and nominally having no water at all or getting it from private sources. As there are very few private wells, and as most of the residents in these houses must drink Croydon water, and also for the sake of brevity, these houses are included with those on the water system of the town. There have been some cases of fever in them, but how many is not known.

App. No. 5.

On Enteric Fever at Croydon, by Dr. Buchanan.

An accomplished member of the local board, taking a wider view, has propounded the theory that epidemics of fever in Croydon, the recent one included, are produced by some fever poison, which he believes to pass from superficial strata into the deep water of the chalk and to be thence distributed in the general water supply, during seasons of exceptionally high or exceptionally low rainfall. I have been unable to follow the arguments by which it is thought to reach this conclusion, and I do not pretend to state them here. But for purposes of reference in this connexion, I think right to extract, from the Memoirs of the Geological Survey, an account of the strata passed through in sinking the old and the new well at Croydon. I also show in a table and diagram, the relation between past fever-mortality and yearly rainfall. These will be found in an appended note (D).

Impurity at reservoirs.

As for impurities having access to the water at the reservoirs, they consist in foul air that may have come up imperfectly disconnected overflow pipes. No importance whatever can be attached to them. The overflows have been properly disconnected while the epidemic has been in progress.

Chemistry of general water supply.

Before reaching this point, I have not considered the affirmative evidence tendered by chemistry in favour of the Croydon well waters; for, undoubtedly, chemistry cannot identify the contagium of fever, and is hardly competent to rebut any positive presumption that on other grounds may have existed against water as a vehicle of fever. But the purity or impurity of water, as it can be told by the chemist, is at least a very important element in the whole question of the relation of water to disease. Now, every chemist to whom the Croydon well water has been submitted speaks of it as a water of the most pure class; and repeated analyses show a constancy in its elements that is a further important evidence of its goodness. It may, in fact, be said that the water, as it leaves the Croydon wells, is, from the chemist's view-point, as pure and as constantly pure as any water need be.

A recent analysis, one of many made by Dr. Dupré for the purposes of this report, gives the following. The specimen was taken from the "arterial main" in Park Lane at 4.20 a.m. on February 13th, 1876:—

Appearance	Clean.
Colour	Colourless.
Taste	Tasteless.
Smell	Inodorous.
Deposit	Very minute trace.
Nitrous acid	None.
Phosphoric acid	Trace.
Metallic impurities	None.
Hardness before boiling	16·3°.
„ after boiling	2·8°.

A Gallon of Water contains	*Grains.*
Oxygen aborbed from permanganate	·004
Total dry residue	21·70
Consisting of volatile matters	1·54
„ fixed salts	20·16
Chlorine	1·01
Nitric acid ($N_2 O_5$)	1·36
Ammonia	0·0007
Albumenoid ammonia	0·0014

A hundred Cubic Inches of Water contain	*Cubic Inches.*
Uncombined carbonic acid	0·56
Oxygen	0·83
Nitrogen	1·78
Sulphuretted hydrogen	None.

Impurity in house services.

Turning to the evidence of impure water being drawn from house taps, I have records of about 40 houses, where this has occurred, all of them within the area supplied with Croydon water. Some 10 of these instances have been merely affairs of cisterns, a small cistern in a confined situation having a waste pipe in direct connexion with a sewer. The most notable case of this sort has already been mentioned in connexion with house drainage arrangements. But in 29 of these instances it was the water drawn from the Croydon water mains that smelt offensively. Some of these cases were learned of by direct inquiry, others by spontaneous communication to the health authority or myself. These cases were scattered up and down Croydon, mostly in single houses, but in one place near South Norwood, of which more particular mention will be made, in a group of houses. The occurrence of bad smell had usually been on one or two occasions only. The following is an example of a not unfrequent communication to the health officer: "In reply to yours of the 15th instant (May 1875), "it is true that one of my children complained of the bad smell and "taste of the water about the time the supply was last curtailed, but "whether her subsequent fever was attributable to the water I cannot "of course say, though we suspect it."

At South Norwood.

The South Norwood case has been the subject of much public comment, but the facts concerning it were not understood in their right proportions until house to house inquiry was made in the locality. A part of the Selhurst road and the Cargreen and Lawrence roads are in question.—In the former there are 40 inhabited houses, 19 on the east side of the way, 21 on the west. Of the 19, no less than eight had fever in 1875, some of them more than once during the year. Of the 21, only two had had illness, and in neither case did the medical attendant believe it was fever. All the 19, and seventeen of the 21, are supplied by Croydon water. In the 19 houses of the east side of the road there was no connexion to be discovered between drainage defects and fever incidence on particular houses; moreover, some of the fever was in houses draining to one public sewer, some was in houses draining to a wholly different sewer. There was no question of cisterns. But there was the peculiarity in house after house of this series, and notably in the houses that had had fever, that the servants had at times, generally at early morning, perceived a bad smell to come from the water taps or from the water furnished by them. This was heard of far more in this group of houses than anywhere else in the course of the present inquiry, and the fact is independent of any view that may be taken of the mechanism of the water-fouling. I failed, it is true, to procure for myself a specimen of the foul water, but it seemed to me impossible not to accept the evidence of the servants, and equally impossible not to connect the ill smell with the otherwise unexplained prevalence of fever.—In the Cargreen and Lawrence roads, there are 13 houses, seven supplied from the Lambeth works, six with Croydon water. Fever has invaded three of the latter, but there has been no definite case in those supplied by Lambeth. In two of the three infected houses (the fact is not known as to the third) there had been some risk to water in cisterns. But bad smell of water as it came from the mains was heard of at one house, where it had been frequently noticed, and was known to the children as being "like onions." I had certain samples of water from these roads collected before 6 o'clock a.m. on February 12th, one from the public main in the street, two from a house where there was a leaking service-pipe and where there had been fever, and two from the house wherein the smell had been observed. Dr. Dupré has examined these five samples, with the result of finding them practically identical with the

sample drawn on the same morning from the arterial main at Park Lane, near the Croydon works. Dr. Dupré found no smell in the samples sent to him, and in his results there is nothing to suggest a reason for any offensive smell. (See appended Note C.)

In the Birchanger road, also in the South Norwood direction, ill smelling water was again heard of, but here it was in houses that had not had fever. A sample of water from a main tap in a house of this road was collected for me in two bottles by the householder, on Sunday February 13th, under the circumstances which he thus notes :—" At " 3 p.m. the water was rather bad, when I filled a bottle ; but on " putting some water in the other I found it better. Therefore I waited, " and at 5 p.m. I happened to use the tap and found the water very bad, " upon which I emptied the former bottle and filled both afresh, fastened " them immediately and put a label on." " At the time the smell was very " strong and disagreeable, and so was the taste. When drawn the water " continued to run from the tap for two or three hours later much in the " same state. . . . The odour was like that of common gas, and per- " ceptible throughout the room it was taken out of; the taste was most " nauseous." This sample, when examined by Dr. Dupré proved to have neither taste nor smell, [it did not reach him for three days after collection,] and to differ in no notable respect from the sample of which an analysis has been given above. (Note C.) Hereon Dr. Dupré observes, " I have heard of a case where a water pipe became filled with " gas to such a degree that when the tap was opened the gas could " actually be lighted. The nose is, however, the only means we have of " detecting the gas in ordinary cases and no chemical tests would enable " us satisfactorily to prove its presence. I invariably examine both taste " and smell of every sample of water I analyse, and this sample certainly " had neither taste nor smell when it came into my hands. What was " smelt was probably more the air coming out of the tap than the water " itself." Dr. Dupré continues, in anticipation of some opinions to the " same effect that I shall have to express, " The point, however, seems to " me of very considerable importance, more particularly if it has been " observed in several parts of the town, since it shows that there are " leakages either in the main or branch pipes. Now we cannot assume " that such leakages exist only in places where there is also a leakage of " gas near ; and the possibility, if not the probability, of sewage finding its " way into the water-supply is thus indicated. The point seems to me " well worth careful examination."

Putting all this South Norwood story together, it seems to me beyond doubt that a variety of local conditions for water contamination have been in operation, some probably leading to coal-gas entering the pipes, others leading to sewer-air or sewage entering the pipes. They are conditions that would be operative chiefly, if not essentially, on the Croydon water, and their occurrence here has had the effect of making that water contrast in a measure with the Lambeth water supply, which is not consumed direct from the main. There is nothing in the facts, however, to suggest that the contamination is due to other than local causes, or that the contrast is between the total water supply of Lambeth, and the total water supply of Croydon.

At a School.

Cases of fever, apparently related to water impurity, have occurred in a large school in the centre of Croydon, and have been the subject of repeated skilled inquiry. The school is on a branch of the low-level water system. It has one wing for 60 boys, another for 40 girls, and a central house for the master's family and the teaching staff. On February 2nd, 1875, soon after reassembling of the school after holidays, a boy fell ill with enteric fever, and the following cases after-

wards occurred :—March 29th, two boys ; April 3rd, one boy; April 11th, one boy and one girl, and a child of the master ; April 25th, 26th, and May 1st, one boy at each date. There was then a break in the disease, and during this break the school vacation. On August 13th, fourteen days after return to school, another boy was attacked, and again there was an interval before other fever occurred. But on October 13th and 15th two more boys were attacked, and on October 14th a female teacher. Other cases, all among boys, happened in succession on October 18th, 19th, 21st, 24th, and 26th, and a case in a male teacher on October 23rd.

The first case of fever, then, may have been an imported one. It afterwards had a special incidence on the boys, and it occurred as two epidemics at the very times when the disease was most prevalent in the town. The occurrences have been in all ways worth studying from the point of view of the general epidemic as well as in the interests of the school itself. All who have investigated it have come to the same conclusion about it, namely, that contaminated water has probably been the vehicle of infection.

The sewers into which the drains of the school discharge have doubtless, since February, 1875, been infected with enteric fever. These sewers are not altogether the same for the boys' department and for the other departments of the school, and the drains themselves have not been quite perfect. But the difference of sewers and the defects of drainage have not been such as to suggest that the infection of fever has entered by this way into the school. Mere infection of particular closets obviously does not account for the outbreaks.

The water service of the several parts of the house and some occurrences connected with it are more suggestively related to the fever. The boys' wing and the master's house are supplied direct from taps on the town main, whereas the girls' school has a large cistern where the water is stored. In March 1875, at the period when the town water supply was exceptionally intermittent, it was twice observed that foul air came from the water pipes in the boys' lavatory. "Here's a jolly stink!" one of the boys was heard to say while waiting to wash in the morning, "we shall be having the water come now." This was some ten days before the first indigenous case of fever in the school ; so that great interest attaches to the source of the foul air. It is to be noted that if that foulness did mischief, it was necessarily upon the boys that it would have most operated. The boys were waiting for their water, and got the first of what came into the school. The master's house would not get its water till the pipes had been emptied of their first contents ; and the girls' cistern was filled with water of the previous day. Many experiments were made during the present inquiry to ascertain the conditions under which foreign matters could be introduced into the water pipes of the school; but, either because the relations of a neighbouring drain to the water main had been altered, or because a leaky water valve hard by disturbed the experiments, or for some other reason, no suction into the school water pipes could be effected. But this much was learned from experiment: That when foreign matter (a pint of Condy) was actually put into the water main supplying the school, it was primarily and in far greatest quantity delivered to the boys' lavatory when the conditions of March last were, as near as they could be, experimentally repeated ; but little was delivered through the house tap, and no appreciable quantity through the pipe supplying the girls' cistern. Hence, if last year any infective matter had entered the water main or the main service of the school, its distribution would have been exactly the distribution of the fever.

The history, however, is plainly that of contamination in a local service,

not of unwholesome quality in the total water supply of the town. The local contamination mereover appears to have been occasional only. It deserves mention that Dr. Letheby, who investigated the sanitary circumstances of the school on November 6th, submitted a sample of the water to analysis, and could not discover any organic impurity in it.

At Shirley.

A curious instance of apparent contamination of water in its course through pipes comes from Shirley. In a paper published by the Local Board of Health on January 28th, 1876, are given the results of some analyses by Mr. Wanklyn of water from the three wells of the Croydon Waterworks, taken on January 13th, 1876, and the results of an analysis by Mr. Wigner of water from the mains of the Croydon Waterworks, taken at Shirley on January 3rd, 1876. It was taken about 9 a.m. from a tap coming direct from the main in the larder of a private house. There is found to be considerable and significant difference between the well-waters and that of the Shirley house-main.

Translated into common denominations, the four elements that were determined for all four samples compare as follows:—

Sample.	Grains per Gallon.		Parts per Million.	
	Solids.	Chlorine.	Free Ammonia.	Albumenoid Ammonia.
From New Well -	22·0	1·1	0·00	0·02
From Old Well -	20·0	1·1	0·00	0·02
From Pumping Well -	22·0	1·1	0·00	0·02
From Shirley house-main	25·53	1·28	0·12	0·38

As the Croydon well waters are, within very trivial limits, constant in composition, it cannot be supposed that the above differences arise from the different dates of collection. Nor are the differences of such a nature or degree as to be explicable on the assumption that they arise from differing methods of the two analysts. And if there really be the amount here indicated of difference between the water of the Croydon wells, and the same water delivered at Shirley, it follows that the water has undergone very serious contamination in its course to the house whence the sample was taken.

Other instances of contamination in pipes.

All these experiences combine into what seems to me a considerable body of evidence to prove multiple local contaminations in parts of the Croydon water service. Nor is the foregoing the only evidence of foreign matters entering the water pipes. During my visit, for experiment's sake, a common house tap was connected with a pan containing solution of burnt sugar, enough to colour some thousand gallons. On the ordinary night-intermission of supply, the whole of this was straightway sucked into the pipes; and except from one neighbour, was no more heard of. It is on record that a few years ago bloody water came from the main tap of a house next to a slaughter-house. In many parts of Croydon it is a matter of every day occurrence to find common air in the water pipes, showing itself as an effervescence which does not pass off for nearly a minute after the water is drawn into a glass. Water thus sparkling is often talked of as "milky," and it may have been this appearance that led a householder this year to report "soapsuds" coming from his tap. This air probably enters for the most part through special openings provided on certain mains for the express purpose of allowing its entry; but there would seem to be no guarantee that the indraught which in one place allows

of air entering at these defined openings shall not at other places lead to the introduction of injurious matters through accidental openings.

Mechanism of this contamination.

The evidence here adduced respecting the entry of foreign matters into Croydon water pipes is independent of any view that may be taken as to the mechanism of their entry. Of this mechanism it is difficult for me to speak with any confidence, inasmuch as, even to engineers, the physical conditions of the passage of liquids along tubes are not universally known. It is clear that at Croydon there are some very awkward relations between sewers and drains on the one hand and water pipes on the other. First, the valves through which the sewers are flushed are direct openings from water mains closed by a diaphragm that is liable to leak, and through which it is, to say the least, conceivable that matters may pass from the sewer into the water pipe on occasions when the water-service intermits. Secondly, the branch mains in particular streets, and still more often the service pipes of particular houses, sometimes lie in the same trench with sewers or house drains : and it is suspected that in places both may be leaking. Thirdly, hundreds of waterclosets are served direct from water mains by mere taps on the service-pipes without any interposition of cistern or other safeguard. During times of full water pressure in the pipes these communications may not be hazardous ; though, as pressure may be taken off a water pipe by making an opening at the farther end of the pipe even more efficiently than by a partial closing of the calibre of the pipe, and as the object of these pipes is to have their farther ends opened, there is little safety in this consideration. It is no doubt mainly at times of intermission of water service that there arise the physical conditions under which suction of matters from without may take place into the water pipes, but I have no reason to believe that such accident can take place only at those times. Some details on these subjects, that, to me at least, are new, will be given in an appended note (E. 1.).

Intermissions of water service.

It is interesting to note the coincidence of intermissions of the public water service with the prevalence of fever in Croydon.

The intermissions were different on the high and low level services of water. The latter (supplying an area in which are 8,403 houses) was cut off during four to six hours, for seven not consecutive nights of January; during eight hours on February 14th ; for three hours in the early morning of March 9th, and then, for repairs to the engine, during the greater part of each day of March 16th–23rd inclusive; after which, with one small exception on April 10th, the service was constant up to May 24th. These intermissions, and especially the long ones in the later part of March, afforded opportunities of a kind that must have greatly facilitated the local entry of various matters into the water pipes. The great increment of fever that occurred at the end of March and in early April was significantly related to these intermissions. After May 24th, fresh intermissions in this service occurred for two or three up to five hours on 12 nights of June; for one or two hours on 17 nights of July; for one or two hours on 24 nights in August, for two hours nightly on 19 occasions in September, and the same on 13 occasions in October. Only twice in November was the low-service supply intermitted, but it was off about every alternate day in December. So far as short intermissions of the low service can have assisted in the admission of infected matters into the pipes of that service, the opportunity of mischief arising by that means was, then, afforded during most months of the year, and so far as this consideration is concerned with the fever, the persistence of the fever is to that extent explained. But these considerations give no help to understanding the fresh increase of fever that in September began, and in October culminated in the area supplied by the low service.—The special high-level service (supplying areas in which are 636 houses besides giving a partial supply to cisterns in 272 other houses that are on the low service) was in the first half of the year constantly on in the day-time, but for five hours nightly the high-service

mains were charged with low-service water. When the low service was intermitted during these particular five hours the high service also was off. And on March 16–23 there was notable interruption of this as of the other service. After July 15th, it became the custom to keep the proper high-level service on all night, and this custom has since been observed, except for two hours on August 19, for one hour in the morning and two hours a and half in the afternoon on September 16th, and for three hours on October 28th, on which occasions the mains were charged with low-service water. It would seem, therefore, that within the high-service area as in the low-service area, there is some suggestion of relation between the early intermissions of 1875 and the growth of fever in the first part of the year; but there is no relation perceptible between the later dates of intermission and the recrudescence and maintenance of fever in the high-service area in the second part of the year.

In short, it appears to me that while conditions of intermitted service are those which specially facilitate the entry of foreign matters into water pipes, it would be a serious mistake to assume that such matters cannot enter the pipes except during periods of intermission. The evidence from Birchanger Road seems to be of importance in this aspect. As has already been said, reduction or removal of pressure within pipes may be quite as well effected by opening the discharge end of the pipe as by reducing the amount of water flowing through the pipe; and that water pipes should often have their discharge-ends opened is of course a universal liability of their existence. The lesson to be learned from all these considerations obviously is that, in order to obtain assurance that the water in pipes shall not become dangerously contaminated whenever the pipes happen to leak, it is necessary that water pipes should everywhere be kept away from all relations with sewers and drains.

Relation of fever to foul water in pipes.

As regards the extent to which befoulment of water in pipes may have operated in the distribution of fever in 1875, I find it impossible to express any opinion. There have been not a few occurrences of fever not otherwise intelligible, which may probably be explained by this befoulment. And it may be that other fever occurrences in places where ordinary sewer defects were observable, have also had to do with entry of infected material into water pipes.

Incidence on water area.

I have next to consider the meaning of the very special incidence of fever upon the Croydon water area, a fact which I learned early in the inquiry, and of which I have only gradually appreciated the significance. Comparison of the tables on pp. 43, 49, and 60 will show that the fever affected a larger proportion of houses within the water area than it affected within the distinctively sewer areas of Croydon. The annexed diagram shows the relation of the two areas, and roughly the chief incidences of fever. It will be seen that the water area is, with an exception to which particular reference will be made, wholly within the two sewer areas.

Now if within a larger area infected with fever by a known means, there be a smaller area more intensely infected with fever, that fact may be due to one or two or all of three things: the known means of fever production may be more intense in the smaller area; or it may have more special opportunities for operating within that area; or there may be a further and independent means of fever dissemination in the smaller area. The circumstance of the smaller area being defined in a particular way must not be allowed to obscure these general considerations, or to raise a presumption that the particular way of definition indicates a new means of spread.

CROYDON.

Scale not quite an inch to a mile.

DIAGRAM OF CROYDON PARISH SHOWING

Most inhabited parts

Water area

Boundaries of Sewer areas

Fever prevalence

Fred^k Dangerfield Litho

To illustrate this position from the experience of Croydon itself, I have examined the incidence of recent fever within the areas respectively supplied by the Croydon and by the Crystal Palace Gas Companies; and I place the results side by side with the corresponding figures for the sewer areas and for the water areas. The Croydon gas area is, like the Croydon water area, a part of the larger area served by the distinctively Croydon sewers.

Houses attacked by Fever in 1875, classified according to area of service.

Nature of Service.	Per 1,000 Houses in special Croydon area.	Per 1,000 Houses beyond special Croydon area.
Sewer - - -	91	8
Water - - -	104	7
Gas - - -	103	13

Now from this consideration of distribution, taken alone, no one would think of accusing the Croydon gas of being concerned in the production of fever. It would at once be perceived that better known reasons for the difference of fever prevalence within and beyond the gas area would have to be investigated ; and that independent reason must be given for believing in the competence of gas to act as a vehicle for fever.

To revert :—There is in fact reason to believe that sewer influences as such have operated more on the central than on the circumferential parts of Croydon sewer areas, just as such influences have often acted most on the central parts of other towns ; and at Croydon this intenser operation has necessarily been within the water area, since the water area comprises the more central parts. There is, secondly, reason to believe that within the water area of Croydon there have been opportunities for the passage of infection from sewers into small confined cisterns, and into water pipes, opportunities that would be greater under the particular circumstances of the Croydon water service than under those of the other water services of the parish. I see no reason, in the facts of the fever distribution, to infer that there has been any further independent means of fever spread within the water area as such.

Fever at boundary of water area.

As regards the fact that in the South Norwood neighbourhood there have been local outbursts of fever just within the Croydon water area, and no such outbursts beyond it, I have already considered the sanitary circumstances of the houses where those outbursts occurred, and I have seen reason for associating them with impurity in the water services to those houses. I have now to observe that (as the above diagram shows) the epidemic prevalence of fever has not reached the boundary of the water area except at South Norwood; that parts of Thornton Heath on the north, and parts about the Croham Road to the south, all supplied from the general Croydon service, have (as before mentioned) been but little attacked. In fact the restriction of fever to central parts has been witnessed within the smaller water area itself.

I have made mention of one exception to the general inclusion of the water area within the Croydon sewer areas. It is the hamlet of Waddon

where drainage is into cesspools, or by other arrangements independent of Croydon sewers. To this exception one naturally turns when question is raised about the influence of the general water supply. Unfortunately, the number of houses available for an answer is small, only 33 in the village receiving their supply from the Croydon wells. There has, however, been no case of fever in any of these houses.

Argument from good drainage of some fever houses.

I have little more to say about the presumption that is created against water by the circumstance that some houses with perfect drainage arrangements have had cases of fever in them. In several such houses the presumption was supported by the experience that ill-smelling water had been at some time delivered to the house, or to some immediate adjacent house. In other such houses the fever-cause had probably been operative beyond the house precincts. In others, again, no opinion about the means of fever reception could be formed. These last instances were not numerous, and their occurrence is not surprising if the infection of the general sewer systems of the town was as intense, yet so unrecognisable to the senses, as it is believed to have been.

Summary as to water-influence.

To sum up the water question :—There is much reason to believe that impurities often get into Croydon water pipes, and that in the course of last year these impurities have been instrumental in spreading enteric fever. Although it is impossible to guess at the number of instances in which fever may have been thus spread, it is judged upon a review of the whole history, that water pollution played a much less considerable part than was played by infection delivered from sewers directly into the air of houses. I fail to find any evidence to support the view that the general water supply as it leaves the wells and reservoirs of the town has been at fault.

Recent action of sanitary authority.

Except perhaps in the view here taken respecting the relative amount and directness of operation of one and another condition in the production of fever, there is, I believe, nothing in this report that will be new to the Local Authority, or to its sanitary advisers. That authority has already, during the progress of the epidemic, taken action in several useful directions. It has taken a step for improving sewer ventilation by removing the trays of charcoal from the air shafts of the public sewers. Under the advice of its officer of health, it is taking such steps as are immediately possible for the completer washing and disinfection of its sewers; it has ordered the removal of the "flushing valves" that formed direct connexion between water and sewer pipes; and it has taken measures for preventing leakage of superficial water into its wells.

There will remain a number of other improvements to be made for the removal of conditions that are held to have brought about the recent epidemic :—

First : all public sewers that are not in good order, or are unequal to their work, must, as rapidly as possible, be replaced by perfect sewers.

Secondly : the public sewers must be completely ventilated ; in such a way as to secure a constant current of air through every foot of sewer in the town.

Thirdly: the direct connexion of houses with sewers must, wherever possible, be interrupted; and an efficient independent system of ventilation be applied to every house drain.

Fourthly: means of sewer flushing must be provided, of a nature not to endanger water services. It will be well that they should be such as to allow the whole interior of the sewer pipes to be washed clean, and on occasion to be washed with disinfectant agents.

Fifthly: as regards water services, two things are at once seen to be needful; a separation, as universal and thorough as possible, of all water pipes from sewers and drains in their course along streets and to houses, and disconnexion of all water pipes from the pans of closets. Then, completer information is needed as to the circumstances under which foreign matters can enter water pipes; and this information should be applied in a detailed examination of the course of every water pipe, public and private.

On certain of the matters here adverted to some information will be found in Appendix E. to this report. On points of engineering and law that may be involved in the above recommendations, I make no pretence to speak.

It only remains for me to acknowledge the assistance that I have received from every one with whom this inquiry has brought me into relation; from the Board of Health and its officers, from medical practitioners, and from a vast number of private persons. The help that has been given me has been most spontaneous and cordial. It has been given at the cost of great personal trouble to individuals; and it has been thoughtful and intelligent almost beyond former experience.

P.S.—April, 1876.—As this report is passing through the press, I learn that there has been a very rapid subsidence of fever in Croydon, amounting almost to a disappearance of the epidemic. This fact deserves to be regarded in connexion with the action mentioned in this report as having recently been taken by the sanitary authority. The agent lately employed for the disinfection of sewers has been perchloride of iron.

NOTE A.

Fever in Croydon, 1875.

In Parish of Croydon, and in various Sub-divisions thereof.	Total No. of Houses, 1875.	Houses attacked by Fever, 1875.		Houses having Deaths from Fever, 1875.		Incidence of Fever attacks upon Houses in the several Months of 1875.												Incidence of Fever on Houses.			
																		In the First Six Months.		In the Second Six Months.	
		Number	Per 1,000 of Houses.	Number	Per 1,000 of Houses.	Jan.	Feb.	Mar.		May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Number attacked.	Per 1,000 Houses.	Number attacked.	Per 1,000 Houses.
In total parish, Urban sanitary district.	11,526	959	83	90	7·8	15	53	79	186	39*	30*	18*	32*	69	275	92	71	402	35	557	48
In parts of parish draining to distinctively Croydon sewers.	10,456	950	91	87	8·3	15	52	79	185	38	30	18	32	69	274	89	69	399	38	551	53
In parts of parish draining to Effra sewers or privately.	1,070	9	8	3	2·8	—	1	—	1	1	—	—	—	—	1	3	2	3	3	6	5
In parts of parish receiving Croydon water supply (note *a*).	9,039	942	104	83	9·1	15	53	78	185	35	30	18	32	68	272	88	68	396	44	546	60
In parts of parish receiving other water supply.	2,487	17	7	7	2·8	—	—	1	1	4	—	—	—	1	3	4	3	6	2½	11	4½
The above combining as follows:—																					
Both drainage and water service on Croydon system.	8,822	939	106	83	9·4	15	52	78	184	35	30	18	32	68	272	87	68	394	44	545	62
Drainage on Croydon system; water not.	1,634	11	7	4	2·4	—	—	1	1	3	—	—	—	1	2	2	1	5	3	6	4
Water on Croydon system; drainage not.	217	3	14	—	—	—	1	—	1	—	—	—	—	—	—	1	—	2	9	1	5
Neither drainage or water on Croydon system.	853	6	7	3	3·5	—	—	—	—	1	—	—	—	—	1	2	2	1	1	5	6

(*a*) Here are included 240 houses within the water area, returned as being supplied from wells, or as having no water at all. As very few of these houses have wells, they are classed here, since Croydon water must certainly be commonly drunk by most of their inhabitants.

* The returns for these four months are less complete than those for the preceding and following months; since some returns were made in respect only of the more strikingly epidemic periods.

NOTE B.

Note, containing Analyses of certain Superficial Waters entering Croydon Wells; presented to the Local Government Board February 11th, 1876.

At the present moment so much interest attaches to the water supply of Croydon, both in connexion with recent disease there, and in connexion with a pending application to Government, that I think it desirable at once to communicate to the Board the analyses recently made for the purpose of my own inquiry. For a right understanding of what the waters are that have been analysed, it is needful for me to write a short note on the Croydon wells; and, that the results of the analyses may be properly apprehended, I shall add a few notes upon them. But I shall not anticipate any of the conclusions which it will be my duty to make.

The Croydon Sanitary Authority supplies water from their wells in Sturt's-yard, in the middle of the town, to a large part of their sanitary area. The wells are three, and interest centres at present on the Old Well. The other two, of more recent construction, are believed to be lined to a considerable depth with impervious materials, and to derive their water solely from boreholes, which penetrate into the chalk to the depth of 150 and 130 feet, respectively, below the surface. These wells are not now in question, except in so far as they may, through their connexion with the Old Well, receive any impurity that enters that well.

The Old Well, sunk in 1851, passes through 4 feet of made earth and 11 feet of valley gravel, and enters the chalk at a depth of 15 feet below the surface. The upper 24 feet of its course (that is, all its course through the gravel, and 9 feet more) are of impervious brickwork and cement, seen to be quite dry on the interior when the well is pumped down. Below this, between the depths of 20 and 34 feet where the well is in the chalk, the well is lined with loose brickwork, giving entrance to certain water, which is the subject of the present analyses. At a depth of 34 feet, the borehole of the well begins, and this passes 43 feet further into the chalk, giving the well a total depth of 77 feet. The great bulk of the water of the Old Well comes from the bottom of the borehole; and, while the well is not being pumped from, the water stands in it about 11½ feet below the surface of the ground.

The 10 feet of brickwork, through which water from comparatively superficial sources can enter the well, forms a cylinder of 6 ft. 4 in. in diameter. The water that enters through this brickwork is derived from the upper layers of chalk, and presumably to some extent from the gravel that overlies the chalk. The analyses now presented have been obtained for the purpose of knowing, so far as chemistry can tell, what amount and nature of impurity may be contributed from these superficial sources to the Old Well water, and thus to the Croydon water-supply.

Previous inquiry on this subject has been made by the Local Sanitary Authority itself. On November 29th, at the instance of Dr. Philpot, the Medical Officer of Health, samples of the water entering the open brick-work of the Old Well were collected and analysed by Mr. Wanklyn. They were taken when the water in the soil was probably of average amount, and when "the "water was pumped down 32 feet below the surface or about 10 feet below the "usual pumping level. The three samples flowed in at about the same level; "A from the north side, B from the north-west side, and C from the south side. "In no case was the flow of water at these points large in amount; and in the "case of B, the flow diminished considerably after a short time."—(Dr. Philpot.)

Mr. Wanklyn's analysis and report are as follows :—

Date—November 29th, 1875.

Name and Description of the Samples of Water.	Grains per Gallon.		Parts per Gallon.	
	Solids.	Chlorine.	Free Ammonia.	Albuminoid Ammonia.
Sample A - -	27·3	1·4	0·2	·14
Sample B - -	44·0	1·4	·12	·26
Sample C - -	25·0	1·5	·00	·22

Hardness: A, 23°; B, 25°; C, 25°.

A and C are very much charged with sewage, and A is not pure.

Analysis was also made of the *total* water yielded by the Old Well on December 4th, 1875. At this time, water from superficial sources was entering the old well to the extent customary in ordinary seasons and during ordinary pumping; and water was rising through the bore-hole at the usual rate of some million and a half gallons daily. This analysis, like the others, was made by Mr. Wanklyn, at the instance of the sanitary authority, Its results are in figures which have to be read under the same headings as before :—

December 4th.

Sample of water from Old Well,
Croydon - - - 24·0 - 1·1 - ·01 - ·04

Water belonging to the most pure class.—Class I.

In collecting samples A B and C it was seen that the side leakage formed but a small proportion to the total yield of the well. The quantity, however, was not measurable, and it was known to be liable to vary, especially with the level of the water in the soil.

The samples which I myself collected and sent to Dr. Dupré, were taken in the middle of the day on January 14th, after the well had been pumped to a very low point on the previous day, and to a point below the top of the bore-hole for some five or six hours. At this date the water in the soil was much more abundant than at the end of November, as was shown by the greater quantity of water flowing along the neighbouring Bourne culvert. A temporary engine was pumping water out of the borehole itself, and the borepipe was exposed in the two feet where it juts up into the well. Hence none of the samples taken from the well were in any degree directly mixed with the deep chalk water; and after the above-described pumping, it is probable that none of them had appreciable admixture with any deep water that might in previous days have flowed out through the brickwork and have returned when the water was lowered in the well.

Sample No. 1 was from a large stream entering at a gap in the brickwork of the well on its north side, at a level 27 ft. 9 in. below the surface of the ground. This stream was stated to be identical with that which furnished sample A for the earlier analysis. Sample No. 2 was taken from a small stream, entering between the bricks near the source of No. 1 on the same level with it. This stream was stated to be in the same neighbourhood as that which gave the November sample B, but could not be said to be in exactly the same place. Sample No. 3 was taken from a moderate-sized stream which issued through a hole on the south side of the well at the same level, and which was stated to have been also the source of sample C taken in November. Sample No. 4 was taken from a very large turbid stream that entered the south side of the well at a level 5 ft. 3 in. below the three before-mentioned streams, at a point scarcely above the jutting top of the borepipe. Sample No. 5 was collected from the basin formed between the well sides and the projecting borepipe. This water was also turbid; it was made up of the aggregate of streams and minor leakages entering the well through the loose brickwork.

Attempts were repeatedly made to measure the quantity of water flowing down the borehole from the bricked parts of the well, but these attempts were

unsuccessful owing to perforation that had been provided in the borehole at the original construction of the well. Such guess as could be made by practised observers put the quantity at 300 to 500 gallons per hour. Of this quantity certainly a half was furnished by streams entering at the lowest level. If 250 gallons an hour entered at higher levels, the three streams from which samples No. 1, No. 2, and No. 3 were taken may be judged to have contributed respectively 120, 25, and 75 gallons per hour. By far the greatest part of the water that entered the upper 6 feet of the loosely-bricked part of the well entered by these three streams.

The five samples were sent to Dr. Dupré without further designation than numbers. He reports on them as follows :—

"Report of Five Samples of Water received from Dr. Buchanan, January 15th, 1876. Each sample contained in one Winchester Quart : stoppers tied over with thin gutta percha : bottles labelled 1 to 5.

"Samples 1, 2, 4, and 5 were, after standing, bright, almost colourless, and remarkably free from organic impurity, as shown by the minute traces of ammonia and of albuminoid ammonia they contain, and the extremely small amount of oxygen they absorb from permanganate. They are of moderate hardness, become very soft on boiling, and have indeed all the characteristics of pure chalk waters. The deposit they yielded (Nos. 1 and 2 in traces, Nos. 4 and 5 in considerable quantities) consisted almost entirely of sand and chalk, with traces only of organic matter, and was, more particularly, absolutely free from living organisms."

"Sample 3 is not so pure. It contains more ammonia and considerably more abuminoid ammonia ; the latter indeed slightly exceeds the proportion a good drinking water should yield. It also contains more chlorine, and absorbs more oxygen than the other four, and, if derived from the same or a similar source has become slightly contaminated by sewage. The deposit consists also of sand and chalk."

"The analytical details are given in the table annexed :—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Appearance	Clear	Slightly turbid.	Clear	Very turbid	Very turbid
Colour	Almost colourless.	Almost colourless.	Slightly yellowish.	Almost colourless.	Almost colourless.
Taste	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless
Smell	Inodorous	Inodorous	Inodorous	Inodorous	Inodorous
Nitrous acid	None	None	None	None	None
Phosphoric acid	Slight trace	Slight trace	Trace	Minute trace.	Slight trace
Hardness before boiling	15 deg.	16 deg.	15·5 deg.	16 deg.	16·5 deg.
Hardness after boiling	4 deg.	4 deg.	5 deg.	4·5 deg.	3·5 deg.
	Grains per Gallon.				
Oxygen absorbed from permanganate.	0·006	0·010	0·016	0·007	0·007
Total dry residue	24·50	24·36	23·94	23·94	23·20
Consisting of Volatile matters.	1·68	1·68	1·40	1·40	2·38
Consisting of Fixed salts	22·82	22·68	22·54	22·54	21·82
Chlorine	1·26	1·29	1·42	1·26	1·26
Nitric acid ($N_2 O_5$)	1·59	1·74	2·04	1·89	2·12
Ammonia	0·0003	0·0015	0·0028	0·0003	0·0003
Albuminoid ammonia	0·0028	0·0014	0·0077	0·0007	0·0007
Deposit	Trace	A little	Trace	Much	Much
Sand and chalk	—	—	—	43·85	44·76
Volatile matters	—	—	—	0·33	0·31
				44·18	45·07

"Westminster Hospital, Jan. 31, 1876. (Signed) A. Dupré."

A careful reading of these results, in the light of what has been stated above respecting the sources of the water and the November analysis, gives important information as to the quantity and nature of the impurities received through the loose brick-work of the Old Well.

The stream which enters at the north side of the well, 27 feet below the surface (sample A of November and sample No. 1 of January), underwent material alteration in the six weeks. It had much increased in quantity, and coincidently with this increase had so far improved in quality that the impurities of November were reduced to a "minute trace" in January, and the water had come to be ranked by the chemist with "pure chalk waters." The change appears at first sight to be due to the increased volume of water in the chalk, operating either by diluting the impurity which this stream formerly received, or by diverting some of that impurity from the well; or in both of these ways; but in view of the greater change which an adjacent stream, next to be mentioned, has undergone, it is now probable that the change in sample No. 1 has been in chief part due to the operation of the same drain alteration that has produced the change in that sample.

The small stream (yielding sample No. 2 of January) is also found to be of great chemical purity; although it was taken from about the same place as the most impure sample (B) of November. I believe the improvement here is not so much an affair of dilution, as it has been the result of the substitution (in mid-December) of an iron pipe in place of an earthenware drain with open joints some 25 yards off the well in a north-westerly direction.

On the south side of the well, the stream yielding sample C in November and sample No. 3 in January, which was "very much charged with sewage" at the earlier period, is shown by the later analysis to have remained so charged, though to a less degree. The source of this stream has been lately made out, and it proves to be such that the stream itself, together with much of the impurity it contains, must be regarded as temporary. The stream has come essentially from water discharged from the engine-condenser into a pit just outside the engine house (thence filtering through 20 and more feet of gravel and chalk), and its impurities have come, in part at least, from a leaking drain made of iron, and doubtless designed to keep sewage out of the soil, between this pit and the well. For some years, apparently since the construction of the present condensed water pipe and drain, there has existed an opening in each; that in the water pipe having been filled by a wooden plug which has rotted, that in the drain having been filled by a mass of cement which has ceased to close the orifice of the so-called T-piece which it was intended to close. The occasion of first leakage from water or from the drain pipe cannot be exactly defined, but it is probable that both leakages took their recent proportions only after the commencement of pumping by the temporary engine, operating to put both water pipe and sewer under pressure; that is, after November 22nd. Subsequent plugging afresh of the opening in the water pipe has put an end to the stream from which sample No. 3 was taken.

The stream, yielding the January sample No. 4 on the south side of the well, but at a lower level than the above stream, viz., at about 32 feet below the surface of the ground, is found to be an ordinary chalk water, which was, except for suspended sand and chalk, of a complete purity, so far as purity can be shown by chemical analysis.

As regards sample No. 5, the water of the basin from which this was collected is the aggregate of all the leakages into the well through the open brickwork undiluted with any water from the borehole. Analysis of this water was not made last year, and the significance of the leakages was, even as matter of quantity, left uncertain. The December analysis, indeed, showed that the purity of the total well water was not discoverably affected by the entrance of impurities through the brickwork. It was seen, however, that with dilution to the amount of 60,000 gallons per hour, even worse leakage than that actually observed, might have escaped detection by the chemist, and it was right to regard (provisionally at least) all water that entered the well above the borehole as being of the same foul nature as the samples examined in November. Much interest, therefore, attaches to the analysis of No. 5 sample. In the change of conditions that took place between November 29th and January 14th, the streams entering through the brickwork became, as analysis of them shows, more copious and

less impure, but it was expected that their aggregate, amounting to not more than 500 gallons an hour, would exhibit a notable quantity of impurity; a quantity that might, indeed, be incapable of recognition after further dilution with 60,000 gallons an hour of pure water from the borehole, but which would, as it existed in 500 gallons, enable a judgment to be formed of the total impurity received through the well sides. Sample No. 5 was collected for the purpose of ascertaining the total amount of this impurity, and the lesson learnt from it is to this effect:—That the impurities contained in particular leakages, including that from which sample No. 3 was taken, are lost so as to be unrecognisable by the chemist, in the aggregate of leakages, amounting at the outside to 500 gallons per hour. This aggregate is pronounced by Dr. Dupré to have "all the characteristics of pure chalk waters," "with traces only of organic matter," and to be "more particularly, absolutely free from living organisms."

Looking at this result; looking also at the improvement that has taken place in the streams from which samples No. 1 and 2 were taken; and again, looking at the nature of the conditions that have been recently befouling sample No. 3, the conclusion is forced on me that the sources of impurity to the Old Well are definite and removable, consisting of a few nuisances in the immediate neighbourhood of the well.

Until I make my report upon the whole case at Croydon, I do not pretend to speak finally on the part which this well may have played in the fever epidemic there; but as regards the present and the future, the sources of pollution which I have found existing are such as to admit of being entirely removed, and it is for the purpose of saying this that I have thought it desirable to write this provisional memorandum. I think it right to add, however, that, recognizing as I do the necessity for every precaution to ensure safety to wells situated in the middle of the town, I cordially approve the action which the sanitary authority is taking in lining the Old Well with iron cylinders down to the level of the borehole, for keeping out of the well all water except that derived from the deeper parts of the chalk.

(Signed) George Buchanan.

February 11th, 1876.

NOTE C.

The following Analyses have been made by Dr. Dupré of Samples of Water taken from Croydon Mains and House Services; the samples as sent to him were distinguished by numbers only:—

Sample A was taken (see p. 50) from the "arterial main" in Park Lane at 4.20 a.m. on February 12, 1876.

Sample B was taken from the main pipe at the junction of the Cargreen and Lawrence Roads at 5½ o'clock on the same morning.

Samples C and D were taken from a house in the Cargreen Road, where the house-service pipe was leaking somewhat. C was from the main-tap, D was from the house cistern. They were taken immediately after sample B.

Samples E and F were taken from a house at the corner of Cargreen and Lawrence Roads, where (p. 51) the water had been sometimes observed to have a smell "like onions." E was from the main-tap, F was from the house cistern. They were taken immediately after samples C and D about 6 a.m. on the same morning.

Sample G was taken from a main-tap in a house in the Birchanger Road at 5 p.m. on February 13th, under circumstances referred to in the Report, page 52. This sample did not reach Dr. Dupré till February 16th.

Dr. Dupré observes upon the several samples as follows:—

"Each sample contained in two Winchester quarts, stoppers tied over with string, and in addition with oilsilk in sample A, with guttapercha in samples B–E, and with paper pasted over in sample G.

"All the waters are colourless, tasteless, and inodorous, and are in every respect pure and excellent. They are all practically identical, such differences as were found being in almost every case within the limits of experimental error. The most appreciable difference is shown in the deposits."

The analytical details are given in the table annexed:—

	A.	B.	C.	D.	E.	F.	G.
Appearance	Clean	Slightly turbid	Slightly turbid	Clear	Veryslightly turbid	Clear	Clear
Colour	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless
Taste	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless
Smell	Inodorous	Inodorous	Inodorous	Inodorous	Inodorous	Inodorous	Inodorous
Deposit	Very minute trace	A little	Very little	Minute trace	Very little	Very minute trace	Very minute trace
Nitrous acid	None	None	None	None	None	None	None
Phosphoric acid	Trace	Trace	Trace	Slight Trace	Slight trace	Slight trace	Slight trace
Metallic impurities	None	None	None	None	None	None	None
Hardness before boiling	16·3	16	16	16	16·5	16·2	16·5
„ after „	2·8	3	3	3	2·5	2·8	3·
				Grains per Gallon.			
Oxygen absorbed from permanganate.	0·004	0·003	0·004	0·004	0·003	0·004	0·005
Total dry residue	21·70	22·54	21·98	22·54	21·84	22·12	22·12
consisting of volatile matters.	1·54	2·24	2·10	1·76	2·24	1·82	2·03
consisting of fixed salts	20·16	20·30	19·88	20·78	19·60	20·30	20·09
Chlorine	1·01	1·01	1·01	1·01	1·01	1·01	1·01
Nitric acid ($N_2 O_5$)	1·36	1·36	1·36	1·43	1·36	1·29	1·36
Ammonia	0·0007	0·0014	0·0007	0·0005	0·0003	0·0007	0·0014
Albuminoid ammonia	0·0414**	0·0035	0·0014**	0·0028	0·0028	0·0030	0·0033
				Cubic inches.			
100 cubic inches of water contains—							
Uncombined carbonic acid.	0·56	0·45	0·63	0·88	1·00	0·52	0·63
Oxygen	0·83	0·98	0·88	1·10*	0·83	0·72	0·90
Nitrogen	1·78	1·96	1·66	2·50*	1·62	1·68	1·78
Sulphuretted hydrogen.	None	None	None	None	None	None	None

* Evidently somewhat over-estimated. ** These two form perhaps the only exceptions to the otherwise general agreement; the albuminoid ammonia is certainly below the others.

A. Dupré,
Westminster Hospital,
February 24/76.

NOTE D.

[*From Memoirs of the Geological Survey, Vol. IV., Part I., pp.* 543–4.]

Croydon.—Well for the Local Board of Health [Old Well]. Sunk and communicated by Messrs. T. Docwra & Son (some particulars added from a MS. section in the Engineer's Office, Metropolitan Board of Works). Yields 1,500,000 gallons a day.

		Feet.
Made ground		4
[Valley drift, 11 feet.]	Rough loamy gravel	4
	Sand	½
	Finer loamy gravel	3½
	Coarse gravel	3
Chalk, 62 feet.	Hard chalk with large flints	15
	Chalk	24
	Hard crust (the greatest supply of water comes from this)	1½
	Chalk	21½
	Total	77

Croydon.—New well for the Local Board of Health, 1864, 56 feet from th older well. Sunk and communicated by T. Docwra & Son. Water rose to a height of 11½ feet below the surface.

		Feet.
Made Ground		5¼
Gravel, 9¾ feet.	Black gravel	1½
	Grey gravel	1
	Red gravel	¼
	Yellow gravel	7
Chalk, 137 feet.	Chalk (with rough gravel 7 ft. down on one side of the well)	23
	Chalk (layers of flint every 6 inches)	10
	Flints and chalk	16
	Flints and rock chalk	29
	Hard chalk	11½
	Yellow chalk	2
	Rock chalk	4
	Chalk and flints	13
	Blue clay	½
	Chalk and flints	12
	Grey chalk	1
	Chalk and scattered flints	8
	Soft chalk	7
	Total	152

Croydon Parish: Fever and Rainfall.—Twenty-five years since the construction of the Bourne culvert and the sinking of the Old Well; showing for each year the deaths from fever; the fever death-rate per 10,000 of population calculated from census data; and the rainfall: with facts as to the flow of the Bourne. (From Dr. Westall's tables, continued by Dr. Philpot: the rates calculated by myself.)

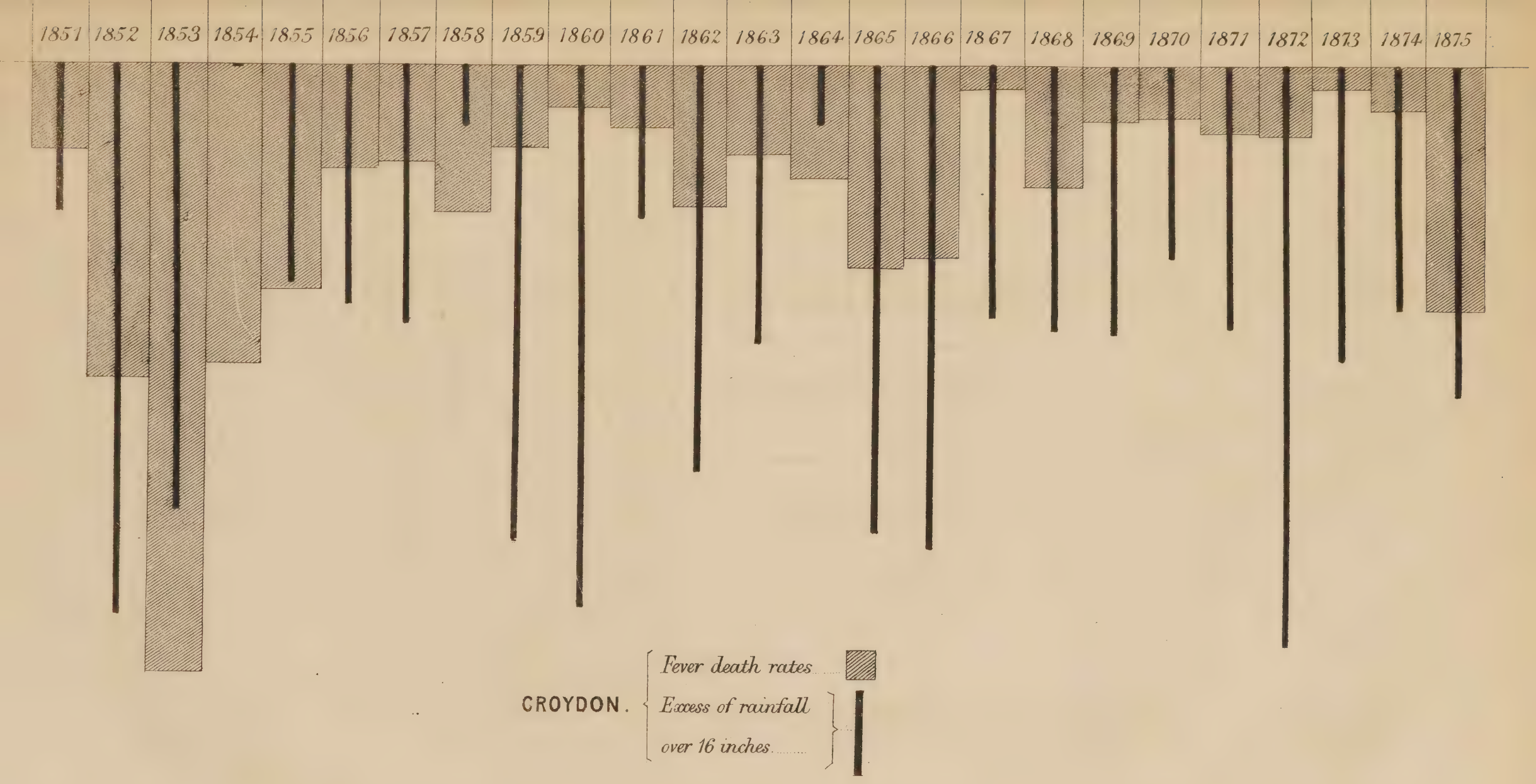
Year.	Fever Deaths.	Rate.	Inches of Rain.	Flow of Bourne.
1851 - -	10	·49	21·01	
1852 - -	38	1·81	33·92	Moderate.
1853 - -	76	3·52	30·51	Copious.
1854 - -	39	1·75	16·02	
1855 - -	30	1·30	23·26	
1856 - -	14	·59	23·95	
1857 - -	14	·57	24·88	
1858 - -	22	·86	18·09	
1859 - -	10	·37	31·82	
1860 - -	7	·24	33·82	Moderate.
1861 - -	11	·36	21·00	
1862 - -	27	·82	29·42	
1863 - -	19	·52	25·01	Small.
1864 - -	27	·66	18·02	
1865 - -	52	1·19	31·47	
1866 - -	51	1·11	32·38	Moderate.
1867 - -	7	·14	24·16	
1868 - -	36	·71	24·58	
1869 - -	19	·35	25·04	
1870 - -	18	·32	22·27	
1871 - -	22	·38	24·54	
1872 - -	24	·41	35·27	} Rather copious.
1873 - -	9	·15	25·71	
1874 - -	17	·27	24·10	
1875 - -	90	1·42	26·87	

The relations of the above are shown in the annexed diagram, the yearly fever-rate being shown by a length of shading; and the excess over 16 inches of the year's rainfall being shown by a length of black line.

[The Croydon rainfall is commonly something larger than the Greenwich rainfall. The excess was formerly seldom more than 2 inches, but in recent years (perhaps owing to a change of observation station at Croydon) the excess has sometimes reached 4 inches. No notice of this fact is taken above or in the diagram.]

NOTE E.

I. The fact that currents from without inwards occur through apertures made in the sides of pipes running full of water is well known, but I have not been able to find an account of the conditions under which these currents are produced. Making some experiments at the Waterworks yard, with the assistance of Mr. Walker, the engineer of the Board, I find (1) the lateral incurrent is freely produced when the water pipe is descending and when the pipe beyond the hole is unobstructed; (2) if the force of waterflow in a descending pipe be moderate, a moderate degree of obstruction beyond the hole does not prevent the incurrent; (3) in horizontal pipes of uniform calibre, when the flow is strong or the pipe beyond the hole is long, or when the end of the pipe is at all turned upwards, the incurrent does not take place, but (4) momentary interference with flow, *a tergo*, or momentary reduction of obstruction, *a fronte*, allows of a momentary incurrent through the hole; (5) incurrent through a lateral hole takes place with incomparably greater ease when the hole is made at a point of constriction of the water pipe.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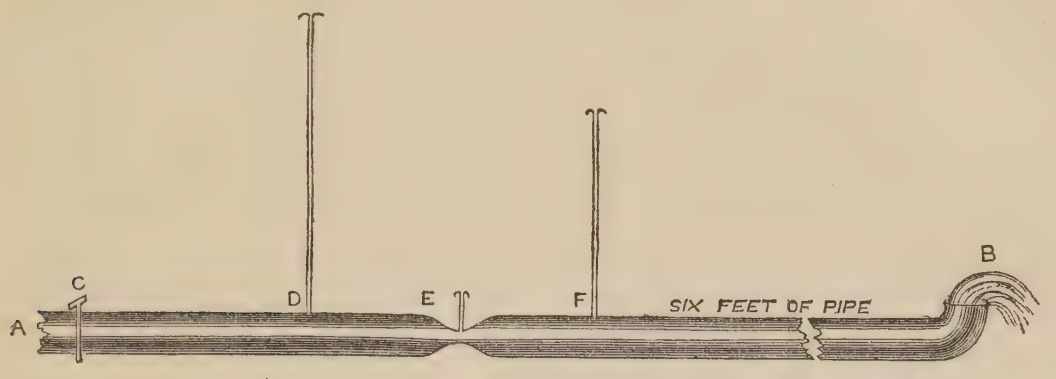
1872
1873
1874
1875
CROYDON.
Fever death rates
Excess of rainfall
over 16 inches

The following is an experiment illustrating the conditions under which these lateral incurrents may be produced in horizontal pipes. The constriction of the pipe, in this and other experiments, was suggested to me by the address of the President of the Mechanical Section of the British Association, W. Froude, Esq., C.E., F.R.S., published in "Nature," in November 1875.



A pipe A B was arranged as shown in the above diagram, the end near B being of indiarubber so that B could be readily closed, and a piece of glass tube being inserted where the break is shown. The end A was attached to a water main running under some hundred feet of head. The pipe had a constriction in it at the point E. Three openings were made on the upper side of the pipe, one at the point of constriction, one D behind, and one F before that point. The tap C being turned on, no matter whether wholly or partially, while B was closed, the indiarubber tube was distended almost to the point of bursting, while long jets issued from the apertures at D E and F. The tap C being turned fully on while B was open, shorter jets issued from the side apertures, their relative heights being somewhat as shown in the diagram. By partial closure of the tap C, these jets were diminished in height, as if by the subtraction of a constant quantity, and the flow from E would be reduced almost to zero, while D and F were sending out jets of a foot or two in height. If, while this is going on, the tube at B were compressed, all three jets at once rose, and the indiarubber pipe swelled as usual; but upon removing the obstruction at B, the effect was for the moment to reduce all the jets below the height to which they had originally risen; the flow from D and F was diminished by some inches, and air entered at E and was seen to pass along the glass pipe. In the next moment the original levels were regained, and air ceased to enter at E. The circumstances that facilitate entry of air through a side hole in a horizontal pipe act *a fortiori* in a descending one.

It seems to me that conditions for the production of lateral incurrents into water pipes may very largely exist at Croydon, perhaps on some larger services, but pretty certainly on many house services. A water pipe descending from the main to a house-basement, to a sink, to a servant's closet, or to a "draw-off" tap, would have the best opportunities for insuction of matters through any hole in its course. But from the above experiment it does not appear that any actual descent is necessary; and it would seem that a leaky sluice-cock on a house water-service pipe furnishes conditions resembling the constriction and perforation (E) of the experiment.

I write the above with much diffidence, as this branch of physics is one with which I am not familiar; but enough, I think, appears to justify the advice that more information on the whole subject should be got. About the importance of indraught into water-service pipes there can be no question, and the very possibility of it, under any circumstances, furnishes an ample reason for dissociating everywhere in their course all water pipes from sewers and drains.

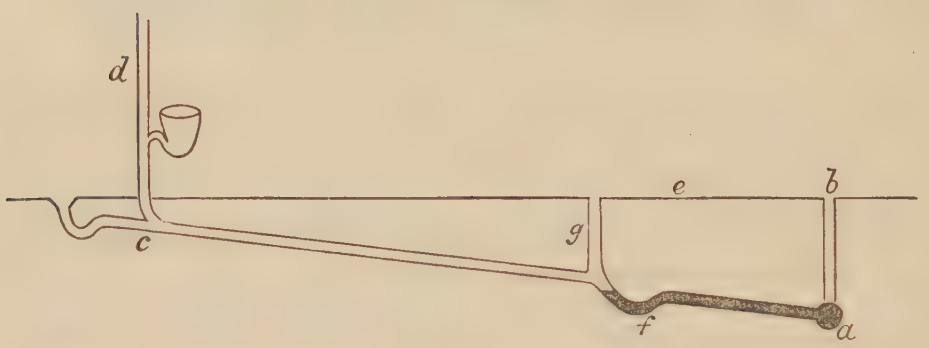
In Croydon, out of a total of 1,291 leaky pipes, taps, and valves of all sorts detected in 1875, there were found 73 leaky service pipes to houses, some of them close to drains or sewers.

It will be observed that experiences considered under the present head must have special concern for districts that are on a "constant service" system.

II. For the purpose of making the separation, advocated in the text, between the air of public sewers and of house-drains, an arrangement of the sort figured in the subjoined Diagram II., may properly be substituted for the existing arrangement which is shown in Diagram I.

(I.)

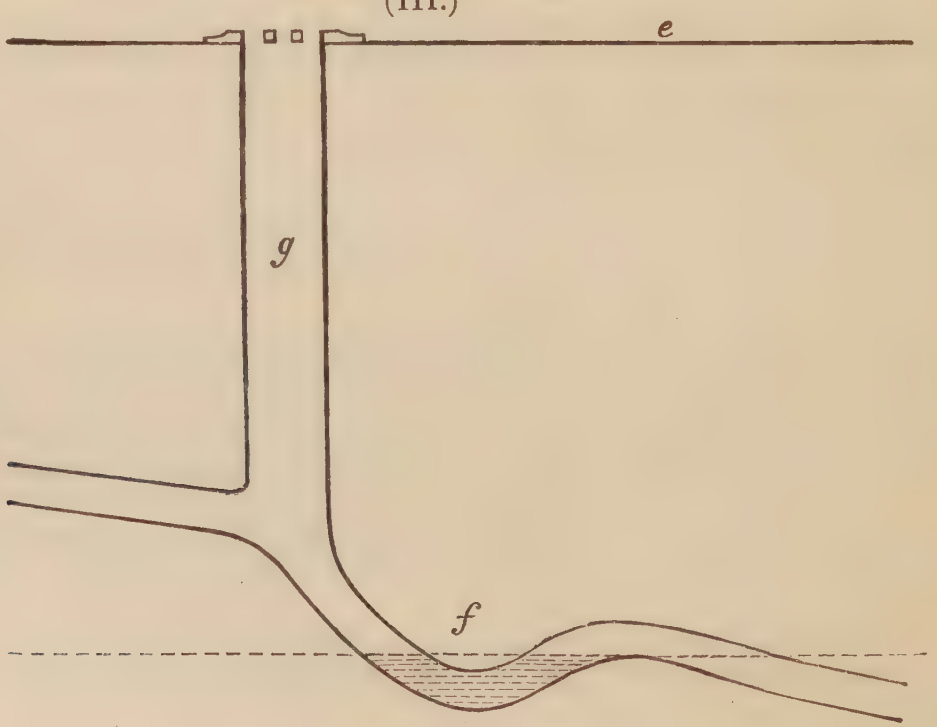
(II.)



a. Public sewer.
b. Ventilating shaft of the public sewer, habitually more or less blocked by charcoal trays. These shafts need to be multiplied. The charcoal trays have already been removed.
ac. House drain.
d. Ventilating pipe of house drain, now habitually too small and requiring to be of the full calibre of the soil pipe.
e. Edge of house precincts.
f. Trap, and *g* ventilator; shown of larger size in Diagram III.

Under proper conditions of the public sewers, the trapping bend (*f*) will keep away from the house all air of the common sewer system; and a few houses in Croydon have recently been provided with such a trap. It is most desirable, however, that with every such trap on a house drain there should be associated a ventilator as shown at *g*.

(III.)



Such a ventilating opening serves three purposes, (1) if the trap (*f*) be ever forced by pressure of air in the public sewer, an immediate exit of the sewer air away from the house is afforded; (2) a continuous ample ventilation of the house drains is provided,—without such opening the prolonged soil pipe merely affords relief to concentrated and urgent drain-air; and (3) a means for inspection of the trap (*f*) is provided, and a way to clean it out if ever it should become choked. It may be observed in diagram III. the drain from the house to the trap is represented as on a higher level than the drain from the trap to the sewer, a longish piece of sharp slope just before the trap being thus obtained. With this contrivance, and in duly proportioned drains, stoppage in the trap is not to be greatly apprehended; and, as before said, if it should occur, it can at once be detected and removed.

The arrangement here shown isolates each set of house drains into a wholly distinct system as shown by the double lines in Diagram II. Even if there should be a little smell from the opening (*g*) it can only be derived from matters that have passed into the drain from the house, and cannot have any fever infection with it, unless there be fever in the house itself. But in effect (I speak from experience of the arrangement under its most difficult conditions) there is seldom any smell whatever from this opening (*g*), for when the drains are in good order it habitually acts as an inlet for air that goes up the ventilating pipe (*d*) by the side of the house; if the drains are not in good order, there may be smell from this lower opening, and such smell should be welcomed as an indication (otherwise wanting till ill-health occurs) of something about the drains requiring amendment.

I, of course, leave constructive details to others, not professing to define the mechanical arrangements by which the principles here set forth may be fulfilled.

It ought to be no objection to this arrangement that the house-drain ventilators (*d*) can no longer serve for the ventilation of public sewers. It is not the business of householders to ventilate public sewers; that is the affair of the authority in whom those sewers are vested. In Croydon the direct connexion between public sewers and the pipes that run up the sides of houses is not only dangerous to the houses, but, in relation to public sewer ventilation, the arrangement is little more than a sham.

III. The following regulations, indicating the right method of supplying water to waterclosets in a place where the so-called "constant service" plan of water delivery is in use, are extracted from the "Regulations under the Metropolis Water Act, 1871." These regulations, having for their object the "preventing of undue consumption or contamination of water," are the result of an inquiry made for the Board of Trade by Lord Methuen, Captain Tyler, and Mr. Rawlinson, C.B. They have the sanction of the Board of Trade and may be put in force by the London Water Companies:—

"20. Every boiler, urinal, and watercloset, in which water supplied by the Company is used (other than waterclosets in which hand flushing is employed), shall, within three months after these regulations come into operation, be served only through a cistern or service-box and without a stool-cock, and there shall be no direct communication from the pipes of the company to any boiler, urinal, or watercloset."

"24. No pipe by which water is supplied by the company to any watercloset shall communicate with any part of such watercloset, or with any apparatus connected therewith except the service-cistern thereof."

No. 6.

App. No. 6.

On Scarlatina at South Kensington, by Dr. Buchanan.

Dr. Buchanan's Report on an Outbreak of Scarlatina in South Kensington.

The following history is of scarlatina attacking a number of people apparently not directly exposed to the infection of an antecedent case.

At a house in South Kensington the household consists of a gentleman and his wife, two sons, four daughters, and two young children; a butler and footman; a cook, kitchenmaid, upper and under housemaid, nurse, and lady's maid. The younger son is absent at the time in question. On June 8th, 1875, the two young children with their nurse leave home and go to the seaside.

On June 9th, 1875, a dinner party is given at this house, 12 guests sitting down to dinner with the host and hostess, their eldest son and daughter. In the evening these 16 persons, together with the other son and daughters and some 150 other guests, assemble in the drawing rooms. On this day the service of the house is reinforced by an extra cook, five waiters, and a charwoman.

In this Report, using letters for names, I shall designate the host's family by the letter A., and the several members of it as follows: A_1, the host; A_2, the hostess; A_3 and A_4, their eldest and second sons; A_5, their eldest daughter; and A_6, A_7, and A_8, their other three daughters. The letters B., C., to K. will stand for such guests as have to be individually indicated; two guests of one family being shown by 1 and 2 following the same letter.

Between June 11th and June 14th the following fall ill:

Of the family, four out of seven who were in the house on June 9th.	(1.) A_2, the hostess;	Scarlatina, first attacks.
	(2.) A_5, the eldest daughter;	
	(3.) A_6, the second daughter;	
	(4.) A_7, the third daughter;	
Of the servants, three out of seven who were in the house on June 9th.	(5.) Cook; probably scarlatina, had scarlatina formerly.	
	(6.) Lady's maid; scarlatina, first attack.	
	(7.) Kitchenmaid; sore throat, had scarlatina when a child.	
Of the dinner guests, six out of twelve.	(8.) B., lady; slight scarlatina, had scarlatina formerly.	
	(9.) C., lady; doubtful scarlatina, never had scarlatina before.	
	(10.) D., lady; sore throat, never scarlatina before.	
	(11.) E_1, gentleman; scarlatina, first attack.	
	(12.) E_2, lady; scarlatina, first attack.	
	(13.) F., lady; sore throat, had scarlatina formerly.	

Of the evening guests, these only (so far as known) out of some 150.	(14.) G., lady; slight scarlatina, had scarlatina formerly. (15.) H., lady; sharp scarlatina, first attack. (16.) I., lady; scarlatina, first attack. (17.) J., gentleman; sore throat, œdema of glottis, never scarlatina before.
Of the occasional servants.	(18.) Charwoman; sore throat, never scarlatina before.

Hence within five days of June 9th, 12 persons who were in the house on that day are attacked with scarlatina, and six others with sore throat, or with sore throat and other symptoms resembling scarlatina. Besides these there was a 19th attack in the person of K., a lady who was not in the house on June 9th, but who lunched there on the 10th and was taken ill with slight scarlatina (second attack) on the 14th. Moreover, one of the waiters had an equivocal attack (does not know as to previous scarlatina), but not till June 18th. One of the evening guests had, within a few days of the party, a sore throat which her medical adviser believes was not scarlatinal; and another guest (a gentleman) at the evening party is reported to have suffered in a similar way to J., but of this guest no particulars have been ascertained.

These were all the cases that could be heard of up to the middle of July. The two children who went to the seaside on June 8th remained with their nurse perfectly well.

The cases here definitely mentioned as "scarlatina" were seen by medical practitioners (seven in number), and no case is here put down as scarlatina except upon medical diagnosis. Of the six cases recorded as "sore throat" and "doubtful," two did not come under medical care at all, in three the symptoms were not such as to allow the medical attendant to affirm the nature of the illness, and in the sixth (J.) no question of scarlatina presented itself to the medical attendants. When the coincidence in point of time and circumstances, between these six cases and the 13 positive cases is taken into account, a presumption arises that some at least of the five may also have been scarlatinal in their nature. All the patients recovered, J. not without the operation of tracheotomy. Kidney affection is not known to have occurred in any of the cases, and is known not to have occurred in most of them.

The following are the details of one of the cases probably about or below the average in severity. The notes are furnished to me by the Resident Medical Officer of the London Fever Hospital:

Laura —, aged 26, admitted June 14th, 1875. Patient is lady's maid in a family living in ——, South Kensington,. As far as she knows she has not been exposed to any infection. She has never had a previous attack of scarlatina. Three days ago she was taken ill with sore throat; she had no vomiting and no rigors. No redness of her skin was observed until the day of her admission into the hospital. On admission, she had a slight scarlatina rash on chest and hands, tongue furred in middle, edges red. Fauces injected, and tonsils swollen; no white patches on tonsils. Evening temperature (E.T.) 101·2°. June 15. Morning temperature (M.T.) 101·0°. No alteration in symptoms. E.T. 101·4°. June 16th, morning T. 101·9°. Less rash; tongue still coated with white fur. Bowels open. Fauces less red; has less pain on

swallowing. E.T. 101·2°. June 17th, M.T. 99·2°. Rash fading. E.T. 100°. June 18th, M.T. 98·0°. Tongue cleaning; rash nearly faded. E.T. 100·2°. June 19th, M.T. 98·8°, E.T. 100°. Rash faded. June 20th, M.T. 98·2°, E.T. 100·2°. June 21st, M.T. 99·2°, E.T. 99°. Tongue clean. June 24. Going on well; no desquamation. June 29th. No albumen in urine; cuticle comes off hands in washing. June 30th. No albumen; fingers desquamating slightly. July 1. No albumen; fingers desquamating still but little. July 2. To get up. July 3. No albumen; no desquamation anywhere but on hands. July 6. Hands still slightly desquamating.

In the management of the outbreak, precautions of the nature of isolation and disinfection were very generally observed,—as generally and as thoroughly as was to be expected. Beyond those originally attacked the disease did not spread, except in the form of feverish sore throat to persons in communication with two of the patients.

At this point, as the remainder of this report will be devoted to questions of etiology, I put together some considerations of interest bearing on the natural history of the disease. First, I recall the absence of any death out of 19 attacks, and the immunity of the patients from kidney disease. Secondly, I note that four persons who had not to their knowledge had scarlatina before and who were exposed to circumstances apparently identical with those that produced scarlatina in 13 others, had no scarlatina rash, but some form of sore throat: one of these four having serious laryngeal symptoms. Thirdly, I note the singular absence of contagion, even from the well-marked cases, to other susceptible persons. That this was not wholly due to the precautions that were taken appears probable from several considerations: for example, there was no spread of scarlatina from case A_7 to A_8, though the girls slept together for two nights after A_7 had become ill.

I became cognizant of the earlier facts of this history on June 17th, and at once set to work to note the progress of the outbreak, and to investigate, as far as I could, its causation. From the medical officer of health of the district, and from the registers of death, I learnt that there was but little scarlatina in the South Kensington neighbourhood, no amount which, if it were multiplied by a hundred, would allow the outbreak to be regarded as being simply a part of a current diffusion of the disease. It was soon apparent too that, except for the meeting at this particular house, there was no common centre of infection or other common local circumstance to account in any degree for the disease attacking these particular persons. I had therefore to confine my attention to the conditions to which the particular household and guests were exposed, and at once saw that the condition causative of disease must have been limited to the particular day, June 9th, or to that day and one or two days near it. That such condition was not operative before June 9th was seen to be probable from the fact that two susceptible children who left the house on June 8th escaped the disease altogether, and these are good reasons for believing that the condition cannot have remained operative for longer than one day or so after June 9th.

Of conditions able to produce scarlatina, and acting under these limitations of place and time, the first that demanded inquiry was any possible personal infectiousness of the household or occasional servants. Now it is certain that for some indefinitely long time before June 9th there had been no scarlatina nor anything resembling it in the household, and careful inquiry failed to discover that any of the occasional servants had recently had scarlatina in their persons or in their families. There was no reason to believe that any member of the household or occasional servant had recently been in communication with any case of

scarlatina. Obviously evidence on this point could not be positive ; but even supposing some communication of this sort had actually taken place, it might account for attacks among individuals so exposed, or possibly for some stray further case, but it could not possibly account for the series of events above described. The circumstances of the outbreak are not such as to suggest infectiveness from guests, but it was ascertained that of the dinner guests none had scarlatina in their households.

At a late period of the inquiry, a notion was for the first time heard of as being entertained by the cook, that the extra cook engaged on the day of the dinner had her hands peeling at the time. I saw this extra cook in the last week of June, and she then had no desquamation, and told me with apparent truthfulness that she had been perfectly well and that nobody in her house had been ill with any complaint.

The evidence respecting direct infection being thus negative, the inquiry was pushed into various other directions. As for fomites, the only sort that circumstances at all brought under suspicion was the dress of some lady member of the family ; but, besides that infection of a dress would not explain the observed incidence upon kitchen servants, it was learnt that of the host's family none of the ladies had new dresses on June 9th, but had before worn the same dresses without ill results to themselves or others. As for local conditions in the house of a kind to generate or convey disease-contagion, they were carefully sought for, but, beyond a full dust bin, no condition of the sort could be discovered, and the dust bin contained nothing beyond the legitimate and everyday contents of such receptacles. Thirdly, the adjacent mews was searched for scarlatina in the people and for any disease among the animals there. This, again, was without result, the only disease discovered being that in the stable next to that behind the house a horse was suffering from "strangles," with old tracheal symptoms, and discharge from the nares. But there was no scarlatina in the mews.

From the first the fact of a dinner party being especially attacked by scarlatina and sore throat had been seen to have a possible significance as bringing in question articles of food or drink. But inquiry in this direction was not elaborated until other more usual causes of the disease were proved to be absent.

The circumstances of the outbreak were now passed under review from this new aspect, and there was soon seen to be some strong *a priori* evidence in favour of the disease having been distributed by means of food.—A number of articles of food not in everyday use were consumed on the particular day, June 9th. The guests at the dinner table, who were the persons who most consumed these articles, suffered most under the subsequent attacks. Servants employed in the preparation of food were attacked more than other servants. The children and nurse, who could not have taken any article of food supplied on the 9th, escaped. A lady who was not in the house on the evening of the 9th, but who lunched there on the 10th, was attacked. The host's family itself suffered to an exceptional degree. On inquiry it appeared that every member of this family who was attacked had double opportunities of partaking of articles supplied to the house on the 9th, while of the members of it who escaped the two were at dinner (A_1, and A_3) had just the same opportunities as the dinner guests. The facts as to the three younger daughters are striking. None of them were at the dinner. All were at the "at home." One of them, going to a picnic next day, went to bed early without taking any evening refreshment, and was not

at lunch on the 10th: she escaped scarlatina altogether. The other two were helped from the supper table and from the lunch table next day; and they both fell ill with scarlatina on the 13th and 14th respectively.

In short, it only needs two easy suppositions to bring all the facts (thus far learnt) of the case into harmony with the view that the scarlatina contagium was distributed by means of some article of food or drink supplied to the house on June 9th. These suppositions are that the article in question was more consumed by ladies than by gentlemen, and that it was much more consumed by the dinner guests than by the evening guests.

The above circumstantial evidence in favour of the outbreak of scarlatina having been by food or drink, and the evidence against its having been due to any other cause must be allowed considerable weight; and I am desirous of pointing out in this place that the evidence so far is independent of any identification of the particular article of food, and is independent of any demonstration of how any article of food can have received its infecting quality. One article of food will presently come into special question, and the story of its relation to persons having scarlatina will be told. This story may or may not add to the foregoing probabilities respecting the source of disease, but nothing that follows can weaken the chain of evidence by which it is above shown to be probable that scarlatina was here introduced by means of something eaten or drunk.

It was manifestly impossible for one person having other engagements to investigate the circumstances of origin and distribution of every article of food that was on the several tables on June 9th. Limitation of the inquiry being essential, it was made in view of the consideration that the article would probably be found among those which had to some extent served the evening party as well as the dinner party. Of these articles, one, and one only, was soon discovered to present some promising speciality of origin and distribution, and it was to this article that the time able to be given to this part of the inquiry was thenceforward restricted.

This was the milk and cream supply, which was regarded as particularly deserving of investigation for other reasons than the foregoing. It had been seen that, in the absence of any strong personal infection, the singularly large proportion of the household and dinner guests attacked, and the similar circumscription of the outbreak both in place and time, presented a strong similarity to the phenomena presented in certain, now numerously recorded, outbreaks of enteric fever, where the material of the disease had been distributed through water or milk. Water was not here in question, so that milk seemed to be particularly worth investigation in its relations to an outbreak, though of another disease, where something eaten or drunk was presumably concerned. But further, there are on record two, if not more, instances of scarlatina itself being diffused by milk, with resulting outbreaks similar to the present, both in the proportion of people affected and in the simultaneouness of attack.

These outbreaks were at St. Andrews in 1869, and at Leeds in 1872. The former of these was well investigated and recorded by the late Professor Oswald Bell, of St. Andrews. Here 26 people were in a short period attacked by the disease. "On making out a list on the spot of houses in which scarlatina had "shown itself in St. Andrews, and on asking the farmer's wife for a list of the "houses which she supplied in the town with milk, the lists, with one excep- "tion on each side, were the same. The exception on the side of the milk "supply had reference to a house where two elderly ladies lived with no young

"people near; that on the side of the scarlet fever referred to a mild case of a "child in a large family, none of whom took the fever." The farmer's wife had milked her cows while nursing a child with scarlatina. The milk boy, having first sore throat, and afterwards desquamation of cuticle on hands and feet, carried milk to town all the while. In both ways, Professor Bell inferred, the contagion was conveyed with the milk from the farm to the town.

The history of the other outbreak was generally similar.

Now at this house in South Kensington, besides an extra supply of milk from the ordinary source, a store of cream was taken in on the particular day, June 9th. And this cream was delivered, partly at 4 o'clock, partly at 5 o'clock in the afternoon. On inquiry of the milkman, Mr. N., respecting the source of the cream, the interesting fact came to light that it was not the same in the two supplies; for that sent in at 4 o'clock had come exceptionally from a London dairy kept by Mr. M., while that sent in at 5 o'clock was taken in the way usual in Mr. N.'s business from milk that had travelled up from Hampshire.

Mr. N. is not sure whether the 5 o'clock supply may not have contained some cream furnished by Mr. M.'s cows. The man who delivered that supply believes it did. But the 4 o'clock supply was "double cream," and was fetched by Mr. N. himself from Mr. M.'s dairy.

Now the cook explains that the 4 o'clock supply was used essentially in the preparation of dishes of ice pudding, custard, and "creams," whereas the 5 o'clock supply was sent up to the dinner and evening tables for eating with fruit and for use in coffee and tea. Of the 4 o'clock cream, however, some that was in excess of cook's requirements was put into one or two jugs along with more or less of the 5 o'clock cream. Hence while the general cream supply of the day was from a Hampshire dairy, the distinctively dinner supply was from Mr. M.'s London dairy.

Evidently, so far as there may be question of milk in relation to the scarlatina, the question can hardly, if at all, concern the 5 o'clock (Hampshire) supply, which was partaken of by large numbers of evening guests without any result, but the question must be of the 4 o'clock supply, that which came from Mr. M.'s dairy, that which was used on the one hand in preparation of dinner dishes, and on the other hand to some very limited extent in the same way as the other supply. For the 4 o'clock cream was distributed essentially to the family and to the dinner guests; and next day, in the shape of certain dishes that had come untouched from the dinner table, to four ladies of the family and their then guest. And scarlatina was distributed essentially among the family and to the dinner guests, with special incidence on the ladies who were at lunch next day. On the other hand, the 4 o'clock cream was not generally distributed to the evening table, and scarlatina, too, was not generally distributed among the evening guests. It is thus seen that the 4 o'clock cream and the scarlatina went, in the main, together, though there were exceptions which obviously required, and promised to reward, more particular study.

It has been attempted to push on the inquiry to the point of learning which individuals of the family and of the dinner party took cream, and in what form they took it. For 19 of the 20 persons of these classes the facts have been learnt with a considerable degree of exactness, and they are recorded in the following table. For one guest who escaped, and who had had scarlatina some four years ago, the facts have not been ascertained. Something has also been learnt respecting certain evening guests.

Inquiries into form in which (if at all) Cream was taken by various Persons.

Persons and form of cream taken.	Persons afterwards ill.	Persons who remained well.
Inquiry made of eleven guests at dinner, numbering	6 persons.	5 persons.
By 8 of the 11, cream was taken in some form or other, viz.:—	by 6.	by 2.
At dinner, in ice pudding	by E_1.	by 2 guests.
At dessert, with fruit	by C.	by no one.
In dining room, with coffee	by E_1.	by same 2 guests.
In drawing room with coffee	by B., C., D., E_2., and F.	by no one.
At evening table	by no one.	by no one.
Inquiry made of eight members of the A family, including their guest of the 10th, numbering	5 persons.	3 persons.
By 6 of the 9, cream was taken in some form or other, viz.:—	by 5	by 1.
At dinner in ice pudding	by A_2. and A_5.	by no one.
At dessert, with fruit	by A_5.	by no one.
In dining room, with coffee	by no one.	by A_1.
In drawing room, with coffee	by A_2. and A_5.	by no one.
At lunch on June 10, in "cream"	by A_2., A_5., A_6., A_7., and J.	by no one.
Inquiry made of four evening guests and their immediate companions, numbering	4 persons.	8 persons.
By 4 of these cream was taken with fruit, or in tea or coffee	by 4	*See note.*

Five companions of three of these evening guests had no cream. Three companions of the fourth evening guest are doubtful whether or not they took any.

It will be observed that of those of the family and dinner guests who were afterwards taken ill all had partaken of cream in one form or other, while of those who were not taken ill a majority had not used cream in any form; further, that the incidence of attack was parallel to the use of cream in certain particular forms. Thus, while the ice-puddings were eaten equally by those who were attacked and those who esacped, no less than seven ladies who were at the dinner, and took cream with their coffee in the drawing room, became afterwards ill, none of them who took that cream having escaped. There was not the same incidence on the gentlemen who took cream with their coffee in the dining room. So of next day's "cream" in its relation to the family and their guest, all those who partook of it were afterwards ill; of those who did not partake of it, no one person was ill.

After what has been said of the distribution of the 4-o'clock cream, something of the above sort is exactly what would be expected on the hypothesis of that cream having been at fault.—The portion of that

cream put uncooked (as before mentioned) into one or two jugs, filled up and refilled from a store of harmless cream, would be expected to work its effects on a small number of persons only; and if it were sent to a defined group of individuals, to cause them to be affected in a group, while others remained free. What if one particular jugfull among many on the evening table contained some of this 4 o'clock cream? Again, cook thinks that one jug, which she remembers to have filled or partly filled from the 4 o'clock supply, was sent to the dining room for gentlemen's coffee. What if, instead, that particular jug was sent into the drawing room for ladies' coffee? Once more, the bulk of the 4 o'clock cream was used for dishes in the preparation of which cream is stirred into other ingredients while they are cooling after having been boiled, or of dishes frozen before being sent to table—custards, "creams," ice puddings. I am not able to guess what may have been the influence of these processes in destroying, altering, or suspending the activity of any morbific matter that may have been introduced with the cream into the several dishes. But what if next day's "cream" retained more than other dishes the original powers of the 4 o'clock cream; or contained them developed or redeveloped by the lapse of 20 hours? Unfortunately no answer can be given to these queries. But the suppositions they contain are not unlikely suppositions, and their truth would give a coincidence, crucial and all but absolute, between the distribution of scarlatina and the distribution of 4 o'clock cream to the several individuals who were in this South Kensington house on June 9th.

The ices on the evening table were not made in the house. The "creams" that were on the dinner table were not on the supper table. Other "creams," made at the same time, were on the supper table.

The servants were not questioned as to which of the two creams they may have tasted, as it was thought those engaged in preparing dinner could not be expected to have any differential knowledge. Incidentally it was heard that the lady's maid partook on the 10th June of the "cream" that was on the lunch table that day.

Upon this evidence, such as it is, the relation of the present outbreak of scarlatina to cream must stand or fall. The earlier evidence showed a considerable probability that the disease was spread by some article of food or drink, and the present evidence shows that the particular article may not improbably have been the cream supplied to this house at 4 o'clock on the day of the party.

The inquiry is next concerned with the circumstances under which the 4 o'clock supply may have become harmful. As I cannot attach importance to the notion (mentioned on a previous page) that the extra cook had her hands peeling on the day of the party, I proceed to tell what I was able to learn of the circumstances of the dairies. Mr. N., whose dairy furnished the habitual milk supply, and on June 9th the greater part of the cream supply to the A. family, had had no scarlatina in his house or among his men; nor, he told me, had there been any at his Hampshire farm. His customers living mostly in the South Kensington neighbourhood did not appear in the course of the inquiry (from the information of the Medical Officer of Health or otherwise) to have had any special scarlatina, if any at all, among them. Mr. M., whose dairy furnished through Mr. N. the distinctively dinner supply to the house of the A. family on June 9th, was then visited. He received me with perfect frankness and gave me all the facilities I could desire. His dairy is about a mile from the house of the A. family, in the sanitary district adjacent to that of which South Kensington forms a part. Inquiry here was threefold: As to any

special prevalence of scarlatina among the ordinary customers of Mr. M. ; as to any scarlatina in his household or milkmen ; and as to the health of his cows.

As to prevalence of scarlatina in customers, some curious facts have come out. The circumstsnces of all 400–500 book-customers could not of course be ascertained ; but the Medical Officer of Health of Mr. M.'s district caused inquiry as to scarlatina to be made at 147 houses in the immediate neighbourhood of the dairy with the result of finding cases of scarlatina or sore throat (during the month of June, but essentially at the beginning of the month), in 44 per cent. of them ; whereas, out of other localities of this district, the street where most scarlatina had been heard of gave out of 60 houses only 13 per cent. as having had scarlatina or sore throat during the month.

This special incidence on Mr. M.'s neighbourhood has an undoubted interest ; but its connexion with Mr. M.'s dairy is found on further inquiry to be obscure. The 147 houses are in a certain square, in a street leading out of it, and in a second street where Mr. M.'s dairy is. Of the 57 houses of the square, 41 were on Mr. M.'s books and 16 were not ; of the 41, 53 per cent. had scarlatina or sore throat in them ; of the 16, only 12 per cent. So that the incidence on the houses known to be supplied by Mr. M. was more than four times that on the houses not known to be supplied by him. But the street leading out of the square has 38 houses, 17 on Mr. M.'s books, 21 not ; of each group 47 per cent. had cases of scarlatina or sore throat, an exactly equal incidence. And the street where the milkman lives has 52 houses, 31 on Mr. M.'s books, 21 not ; of the former 48 per cent. had case of scarlatina or sore throat ; of the latter 33 per cent., the difference of incidence being less than as $1\frac{1}{2}$ to 1. It is true that the inquiry failed to bring out the facts with the precision that was to be desired. On the one hand, comparison of the scarlatina with houses taking Mr. M.'s milk was only made in regard of those houses in which book-customers lived, such of the houses as obtained ready money supplies by sending round to the dairy not being included. On the other hand, in regard of all those houses (of which there were many) occupied by more than one family, there is no evidence that it was the family that took Mr. M.'s milk that suffered from the current ailment.

An outbreak of these proportions, occurring in this sudden fashion, is itself an exceptional circumstance ; and such further particulars of it as were learnt for me may here be noted. The cases of sore throat and scarlatina occurring during June (with which some days at the end of May should probably be included) numbered in all 175, and were heard of in 64 of the 147 houses in the square and two streets ; and of the 175 attacks, 56 were spoken of as scarlatina, and 119 as sore throats ; of the latter, however, some are known on medical evidence to have really been scarlatina, and 27 of them were in 10 houses where there was also recognised scarlatina. There was an unusual prevalence of erysipelas in this same district, and some of the sore throats may possibly have been erysipelatous in nature. Of the 56 recognised scarlatina attacks, 47 occurred before the end of the first week of June, in 22 different houses, a whole family being in some instances attacked nearly simultaneously. Of the 119 " sore throats," 83 occurred before the end of the first week of June in 34 different houses, here again a whole family being frequently attacked nearly on the same day. There were thus in the course of a week or two, 130 cases of scarlatina or sore throat, and it is a remarkable circumstance that from this large number of cases there was no extensive spread of the disease ; up to the end of June only 45 other cases of scarlatina or sore throat being heard of in this square and two streets ; the prevalence of scarlatina in the district generally (so far as death-registers show) being meanwhile on the decrease. Another noteworthy circumstance is the small mortality of the outbreak, a

fact that has to be noted in connexion with that mildness of disease that caused some cases, really scarlatina, to be considered as mere "sore throat," and that in many other cases allowed of no doctor being called in. If there were only 56 cases of real scarlatina, however, three or four deaths would be expected to occur among them, but in fact there was but one death from scarlatina or any similar disease in these three places during the 10 weeks ending July 31st. In these respects, in comparative absence of diffusion and in mildness of attack, the outbreak in the neighbourhood of Mr. M.'s dairy corresponded with that which forms the subject of this report. Further, it deserves mention that one case of the "sore throat" prevailing hereabouts was of a nature to suggest, to a practitioner residing in the neighbourhood, that tracheotomy might become necessary.

As to scarlatinal disease among Mr. M.'s household or milkmen, almost nothing could be heard of. After much questioning in a variety of directions, the only hint of such disease among these people was that a boy employed to milk the cows and carry out milk, lodging in a house where there was no scarlatina before or for some time after, but whose mother, remarried and living in another street, had scarlatina in her family in May, went on May 10th to a doctor for a sore throat. The doctor says he had no rash, and that his fauces were ulcerated. He prescribed a gargle, and repeated it on the second and only other occasion of his seeing the boy, on May 13th. The boy says he had not had scarlatina when young. When I examined the boy's hands on June 21st they were not desquamating, though the tips of the fingers looked tender.

As to disease in any of the cows at Mr. M.'s dairy, I have the advantage of Professor Brown's authority for saying that in the middle of June there was none. On a visit which he then made with me to the dairy, the animals were found to be in typical health.

Finally, the evidence which I have adduced in this report does not conclusively demonstrate the cause of scarlatina in this South Kensington outbreak. All that can be said is that the distribution of the disease is wholly unaccounted for, unless infection of a particular cream supply accounts for it. I believe the failure to get more definite evidence has been owing to the complicated nature of the conditions that had to be investigated. I should hope much from the prompt investigation of future cases that may bear a general resemblance to the foregoing, more particularly if they occurred under the simpler circumstances of a rural district. Already two or three instances, having many points of resemblance to this South Kensington outbreak, of scarlatina apparently spreading from dinner tables, have been met with in London since this inquiry was begun. Concerning them I have only to record in this place that they throw no light on the causation of the outbreak which is the subject of this Report.

No. 7.

App. No. 7.

On Levantine Plague, by Mr. Netten Radcliffe.

Memorandum by Mr. Netten Radcliffe on the Modern History and Recent Progress of Levantine Plague.

England and Europe, the latter half of the 17th century. 1665–1679.

Plague, which for an undetermined period had prevailed in England, either as a continuously present disease or as a series of frequently recurring epidemic invasions, after the great outbreak of 1665 quickly subsided and became extinct. In the year named (1665), according to the Bills of Mortality, it caused in London, which is supposed to have then had a population of about half a million persons, 68,596 deaths; in the following year (1666) 1,998 deaths; and in the subsequent 13 years (1666–1679) 81 deaths. After the year 1679 no death from plague was recorded in the Bills of Mortality. In the year 1704 the name of the disease was omitted from the Bills, and it has not since had a place in them.

The great outbreak of plague in this country in 1665 was part of a general diffusion of the disease, common probably to the countries lying east of the Mediterranean, to Europe, and to Northern Africa. In parts of Central, Southern, and Eastern Europe the disease was still prevalent as the century drew to a close, and early in the following century (the 18th) it again became active and spread very widely in Continental Europe, the countries of the Levant, and in Northern and North-Western Africa. As the century advanced plague died out in Western and Northern Europe and in the greater number of the countries of Central Europe, but in Eastern Europe the disease continued into the present (the 19th) century.

The 18th century.

From the period of cessation of plague in this country in the 17th century to the termination of the 18th century, the phenomena of the diffusion of plague in Europe, as far as the imperfect data existing on the subject permit a judgment to be formed, indicate a gradual diminution of the area within which the malady could retain its activity. The better recorded phenomena of diffusion of the disease within the present century show such diminution proceeding at a greatly augmented rate until the apparent extinction of the malady over the whole area of its previous range of prevalence in Europe, Northern Africa, and the countries east of the Mediterranean, the disease apparently at no time presenting any amelioration of its accustomed virulence.

The 19th century. 1800–1824.

In 1812–14, plague became widely diffused in the Levant, in the districts bordering the Lower Danube, in Transylvania, in Asia Minor, and in Armenia, also in Northern Africa, west of Egypt. This diffusion continued in one district or another within the area of dispersion throughout the next 20 years, but during the whole of that period there was no extension into Central, Northern, and Western Europe. Hardly had the diffusion beginning in 1812 come to an end (if, indeed, it had wholly ceased) when plague again became active in the Levant. Greatly as the area of prevalence had diminished in the previous diffusion, as compared with still earlier diffusions, the area was still further lessened in the diffusion which commenced in 1834–35.

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* The orthography of Keith Johnston's *Index Geographicus* has been, as a rule, followed in the spelling of proper names in the text of this memorandum. In dealing with numerous reports of many writers, each of whom uses apparently his own system of orthography, I may not always have secured uniformity, and where I have had occasion to quote I have retained the orthography of the writer; but, little difficulty will be experienced, I believe, in recognising places and communities referred to, although they may appear in various orthographical guises.

To illustrate Mr Netten Radcliffe's Memorandum on Plague

SEATS OF PLAGUE

1867, 1870-71 & 1873.-74.-75.

○ *Districts infected.*

60° 70°

50° 70°

40° 60°

30° 50°

20° 40°

10° 30°

30° 40° 50° 60° 70°

EUROPE

MEDITERRANEAN SEA

BLACK SEA

TURKEY IN ASIA

CASPIAN SEA

ARAL

TURKESTAN

KURDISTAN

1870-71

SYRIA

TRIPOLI

1874

Benghazi

Alexandria

Cairo

Bagdad

Teheran

1873-75

1867

PERSIA

EGYPT

RED SEA

ARABIA

PERSIAN GULF

AFCHANISTAN

Mecca

1874

BELUCHISTAN

ARABIAN SEA

Bombay

Dangerfield, lith. 7, Bedford St. Covent Garden.

This latter diffusion, the last from which any part of Europe suffered, was chiefly confined to the Turkish dominions in Europe and Asia and to Egypt. The malady extended to the towns and districts of Wallachia bordering the Danube, and also into Greece, but no other countries in Europe contiguous to Turkey were affected. In Africa, the malady appears to have been limited to Egypt. Five years after the commencement of this diffusion, namely in 1839, plague disappeared from Constantinople, and two years after its cessation on the Bosphorus it died out in the European provinces of the Porte.

1834–1841.

Cessation of Plague in Europe, 1841.

While plague was thus becoming extinct in Europe, it again became actively diffusive in Egypt, Syria, and Palestine (1840–41.) The disease was apparently not less virulent in this diffusion than in previous diffusions, but except, probably, some dispersion into parts of Asia Minor, it did not spread beyond the countries named. With the termination of this diffusion plague vanished from the East. No case of the disease is known to have occurred in Syria, Palestine, and Asia Minor since 1843, nor in Egypt since 1844.

1841–44.

Cessation in Syria, Palestine, and Asia Minor, 1843.

Cessation in Egypt, 1844.

For centuries Egypt and the countries lying to the east of the Mediterranean had been regarded as the birth-place of the several diffusions of plague which had spread over Europe. In these countries the disease lingered longest and was latest to disappear during that gradual decrease of the area of prevalence, which observed in this country after the great outbreak of 1665, came to an end in Egypt with the apparent extinction of the disease, in 1844.*

The Re-appearance of Plague. Western Arabia, 1853.

Fourteen years after the cessation of plague in the countries where it is believed to have previously prevailed from time immemorial, the disease again appeared in the basin of the Mediterranean, within the province of Tripoli, the easternmost state of Barbary. During the interval no previous prevalence of plague had come to knowledge, but it is now known (the fact having been ascertained in 1874) that plague had been present in the highlands of Western Arabia in 1853. In that year an outbreak took place in the mountainous region of the Assyr district, North Yemen, part it would seem of a wider diffusion of the disease in Arabia. The mere fact appears to have been alone ascertained during an inquiry made under the direction of the Ottoman Government relating to the appearance of plague in the same district in 1874.†

Bengazi, Tripoli, 1858–59.

In 1858, about the middle of April, plague broke out in the province of Bengazi, Regency of Tripoli, North Africa. This province (the ancient maritime region of Barca, including the Cyrenaica or Pentapolis), celebrated of old for the fertility of its highlands and of its littoral, affords pasturage for many flocks and herds and yields rich crops and grains, notwithstanding an imperfect and partial cultivation of the soil. The population is chiefly nomadic, frequenting the higher grounds and the table-land of Merdj during the hot season, when the pasturage in the plains has been parched up and withered, and returning to the low-lying tracts after the autumnal rains, when they have become covered by luxuriant vegetation. The fixed population is principally accumulated in the only two towns of the province, namely, Bengazi (built on the site of the former Berenice and more

* See as to prevalence of plague during the early part of the 19th century, Dr. Gavin Milroy's "Sketch of the Geography, &c. of the Plague during the Present Century" (the British and Foreign Medico-Chirurgical Review, Vol. XXXIII. (Vol. I. 1864), p. 463; also Hirsch's *Hanbuch des historisch-geographischen Pathologie*, Vol. I., p. 197.

† See on this subject a letter of Dr. Dickson's, p. 54.

remote Hesperides), and Derna (built on the site of the former Darnis), each of which towns contains about 12,000 inhabitants. Villages formed by small groups of miserable huts exist on the littoral and in the interior, and several Arab monasteries; and certain Arab tribes occupy cave dwellings.

Plague, in 1858, first appeared in the province of Bengazi, in an Arab encampment consisting of 30 huts, pitched at the time eight hours distant from the town of Bengazi, in the plain of Amalisgalen Fiddaar. The disease was next observed in the town of Bengazi at the beginning of May, and afterwards it spread throughout four of the five districts into which the province is divided, namely, Bengazi, Derna, Gharb, and Chark, affecting both the nomadic and the fixed populations. Derna was attacked at the close of May or beginning of June, the development of the malady there following upon an importation of a case from Bengazi; and Merdj, the chief place of the district of Gharb, a village situated on the Cyrenaic plateau, and having a fixed population of 100, together with a garrison of 100 soldiers, was attacked about the 15th June. The district of Auldja, which has a very scanty fixed population living in the midst of sandy desert escaped the outbreak.

The disease was most prevalent and the loss of life from it was greatest during the year 1858, but it continued into the following year, disappearing from the towns of Bengazi and Derna in June 1859. The number of attacks which occurred is not known, but the mortality among the sick who came under observations was about 40 per cent., and the total deaths were estimated approximatively to have been 4,000.

This appearance of plague in the province of Bengazi had been preceded by four years of drought and consequent failure of crops. Each successive year the miseries arising from dearth had increased. The greater part of the flocks and herds were destroyed from want of food and the mortality among horned cattle was augmented by a fatal epizootic which attacked them. Plague appeared when the sufferings of the population from famine were greatest.*

Persian Kurdistan, 1863.

In November 1863, the Ottoman quarantine physician at Bayazid, on the Turco-Persian frontier, reported the occurrence of a fatal bubonic disease resembling plague in the district of Maku,† Persian Kurdistan. The nature of this disease and the conditions under which it was developed were investigated by Dr. Rossi, the inspector of quarantine at Erzerum, under instructions from the Ottoman General Board of Health. Dr. Rossi was accompanied during his investigation by Dr. Auriema, Dr. Pandeli, Aali Effendi, director of quarantine at Bagajid, and Miza Aga, a member of the Municipal Court at Bayazid. The result of his inquiry is thus described in a report by Dr. Dickson, to Her Majesty's Representative at Constantinople, dated 29th December 1863.

"Dr. Rossi examined eight cases affected with this malady and the symptoms presented by them were as follows:—The invasion of the complaint was marked by fever of a burning nature; lassitude and great debility; dejected aspect; vertigo; headache; intellect more or less disturbed; tongue dry or

* See on this outbreak a report by Dr. Bartoletti, who was commissioned, in conjunction with Dr. Amadeo, to investigate it; and various reports regarding the outbreak made by Dr. Fauvel, who was the sanitary representative of France in Constantinople at the time (and which include summaries of Dr. Barozzi's reports, who was sent to Bengazi by the Ottoman Government early in 1859), published in the *Recueil des Travaux Comité Consultatif d'Hygiène publique de France*, tome 4e, pp. 151–212.

† The town of Maku (province of Azerbijan) lies in the extreme north-west of Persia.

covered, with white fur; constipation; and darting pain with swelling either in the axilla or in the groin. These were followed from the second up to the fifth day, by the appearance of one or more sloughing boils or carbuncles on that side of the person which had been affected with the glandular pain and swelling. In two instances the sides of the neck were painful, followed on the third day by a sloughing boil on the cervical vertebræ. On the appearance of the boils, the axillary and inguinal swellings subsided. In one case the manifestation of a carbuncle was followed by diarrhœa. When the boils suppurated, the patients generally felt relieved.

"The population of Maku is estimated by Dr. Rossi at 1,500 inhabitants: Of these about 50 were said to be actually laid up with the distemper. A month before, double this number were ill; but the epidemic had considerably diminished after the fall of snow and lowered temperature.

"The epidemic originally declared itself in the month of September among the tribe of Jellali who reside at 'Ak-Ghiol,' 11 hours distant from the frontier, opposite to Erwan, and subsequently appeared in the town of Maku. It was asserted that no deaths ensued from it, but Dr. Rossi was impressed with the idea that the Persians were endeavouring to conceal the truth from him. In the villages of 'Akdahan' and 'Danali,' several deaths had occurred and come to his knowledge. The distemper still prevailed at 'Ak-Ghiol,' and Aali Khan, the ruler of Maku has prohibited the admittance into his territory of those Koordish tribes who are affected with the disease.

"Dr. Rossi considers the epidemic to be one of *true plague*, and he attributes its manifestation to the severe murrain existing at Maku, which infects the whole district with putrid emanations arising from the unburied bodies of dead cattle, the use of diseased meat as food by the inhabitants, and poverty, owing to the failure of the crops. . . . .

"The Board of Health, neither satisfied with the inspection made by Dr. Rossi, nor convinced that the distemper reigning at Maku is really the plague, have ordered Dr. Bimsenstein, their Sanitary Agent at Teheran, to proceed without delay and take up his residence at Maku, and report from time to time on the nature and progress of this malady."

Dr. Bimsenstein visited the district of Maku in January 1864. His inquiry included the town of Maku and 25 villages, but not the nomadic tribe among whom the disease first appeared. He discovered one case only of bubonic disease, which he believed to be plague, the patient, a young man, being convalescent at the time. As the general result of his investigation, Dr. Bimsenstein, in a report dated the 15th February 1864, writes:—"Pour moi il n'y a pas de doute que la peste y avait existé parmi "les nomades et que le bruit qui courait alors de l'existence de cette "maladie était bien fondé."*

The Lower Euphrates, 1867.

Eight years after the outbreak of plague in the province of Bengazi, and four years after the reported occurrence of the disease in north-western Persia, the malady appeared among the Arabs inhabiting the Hindieh marshes on the Lower Euphrates. These marshes lie on the west bank of the river in close proximity to the ruins of ancient Babylon, and they cover a district measuring about 60 miles in length from north to south, and 20 miles in breadth from east to west. Into the northern extremity of these marshes opens the Hindieh canal; and their southern extremity communicates with the great inland lake known as the Sea of Nedjef (the Bahr-i-Nedjef). The Hindieh canal as a navigable channel which begins, according to Mr. Kennett Loftus, about two miles below the Khan at Musseib, and about 16 miles above

* Sir Samuel Baker, in his account of the discovery of the Albert N'Yanza, describes a pestilential outbreak of disease, observed on his return journey, at Khartoum, late in 1864 and at the begining of 1865. He writes of it as "plague" or "malignant typhus." None of the symptoms most characteristic of the former disease are mentioned, and the latter designation, so far as the description admits of a judgment being formed, would seem the more accurate one. (*The Albert N'Yanza Great Basin of the Nile*, Chaps. 18 and 19.)

the existing ruins of Babylon. It follows the course of an ancient canal constructed for the relief of the low-lying grounds east of the stream during its periodical floods, and for purposes of irrigation, and derives its present desigation from an Indian prince who, a century and a quarter ago, opened out the channel which had then become blocked. The mouth of the Hindieh is dammed so as to regulate the amount of water passing into it, but at times, in exceptional floods, the dam is carried away. The vast body of water which then passes through the canal, converts the whole district lying between its outlet and the Sea of Nedjef into an inundation, as also the district laying between the outlet of that sheet of water and Samava. When the river has fallen to its usual level, the mouth of the Hindieh remaining open, a deep stream 180 feet wide passes along the canal into and through the marshes to the Sea of Nedjef, and by this route and the streams flowing from the Sea of Nedjef into the Euphrates merchandise is is conveyed from Hillah to Basra. Indeed, along this route, through the Hindieh marshes and the Sea of Nedjef and its outflow, it would appear that at the present time navigation can alone be maintained between the Upper and Lower Euphrates. For the volume of the river is so greatly diminished by the amount of water passing through the Hindieh canal and certain other canals that below Lamlum the stream in the proper channel is entirely absorbed in the extensive rice-fields which exist there.*

West of the Hindieh marshes is the Syrian desert, and to the north-west, on the skirt of the desert, within eye-shot, Kerbella (Meshed Hussein), and to the south overlooking the Sea of Nedjef, Nedjef (Meshed Ali). Nedjef, the burial place of Ali, the fourth Caliph, and Kerbella the burial place of his two sons, Hussein, "the Martyr," and Abbas, are sacred to the Shiah Mahommedans. They form a centre of pilgrimage, second only in importance, among the Mahommedans, to that of Mecca. To both cities annually resort many thousands of pilgrims from Persia, the Mahommedan districts of Caucasia, and from Hindostan, carrying with them great numbers of corpses in all stages of decomposition for burial in the sacred soil. Pilgrims from Caucasia, northern, central, and eastern Persia, travel to their destination by way of Bagdad and thence to Musseib (crossing the river at that place), and Kerbella, or to Hillah (traversing the stream there) and through the Hindieh marshes by boat to Nedjef. Pilgrims from Southern Persia and Hindostan ascend the Euphrates to Samava, and then pass along the principal outlet of the Sea of Nedjef, the Shat-el-Atchan (the western branch of the Euphrates, as it has been termed) and cross the Sea of Nedjef to Nedjef. Many pilgrims, after performing their devotions at Nedjef and Kerbella, travel onwards to Mecca, by way of central or northern Arabia or Syria. Others first perform the pilgrimage to Mecca, visiting Nedjef and Kerbella on their return homewards. In 1871 a caravan of pilgrims bound for Mecca, which had left Nedjef at a time when cholera was prevalent there, and travelled by the northern route through Arabia introduced cholera into Haïl, the chief town of the Jebel Shomer district. Thence the disease was propagated to Medina, Mecca, and the east coast of the Red Sea; and in the following year (1872) it spread into Nubia.

The Hindieh marshes are inhabited by many communities of Arabs of the Beni-Taraf tribe. These live in villages erected upon the islets within the marshes or upon the outskirts. The villages, for the most

* See Surgeon-Major Colvill's Report on Plague in Mesopotamia, 1875. Note, p. 18.

To illustrate Mr Netten Radcliffe's Memorandum on Plague.

THE SEAT OF PLAGUE ON THE RIVER EUPHRATES IN THE YEARS 1867 AND 1873-4-5

BAGDAD
River Euphrates
River Tigris
Musseib
Kerbella
Hindieh
Tanabi
BABYLON
Hillah
Birs Nimrud
Kifl
Kut el Amarah
Hai
Dagarra canal
Tel Niffer
Kufa
Nedjef
Abu Fadi
Affy Marsh
Suk el Affy
Bahr
i-Nedjef
Al Kachi
Diwanieh
Wasit el Hai
Shat el Hai
Shat el Kar
Great Syrian Desert
Hamza
Fawwar canal
Lamlum
(abandoned)
Jawariyah
Ramoetha
Turungen
Fawwar
Shinafieh
Montefik Arabs
Aber Rufoosh
Shat el Afchan
Samava
Warka Ruins
Shatra
Al Khythr
Al Khytr
Al Asaniyah
Nassreah
Suk-e-Shevukh
Scale of English Statute Miles
0 5 10 20 30 40
44° E.Gr.
45°
46°
32°
31°

Dangerfield, 22 Bedford St Covent Garden.

This Map is based upon a late Survey in the possession of the India Office. The position, as described by Mr Colvill, of the Aber Rufoosh, of certain places, and of the rice fields below the site of Lamlum where the stream running along the proper Channel of the Euphrates is lost, are indicated conjecturally

part are formed of huts, or rather "dug-outs" hollowed in the wet soil, and roofed with reeds covered with matting or thickly plastered with mud. The wretchedness of these dwellings is augmented by the indescribably filthy habits of the occupiers in persons and surroundings. Rice is largely cultivated by the different communities, but not to the exclusion of other grain, and they possess large flocks of sheep and herds of cattle. The men of the Beni-Taraf tribe are described as remarkably well-limbed, active, and athletic. They and their families live chiefly upon rice (eaten it is to be presumed, although this is not stated, with sheep's-tail fat, as pillaff), bread, and dates, little flesh meat being consumed. Recent medical visitors to the marshes have stated that the communities are singularly free from signs of marsh poisoning. On the other hand malarial fevers (occasionally pernicious) are spoken of as occurring in the district. Very probably the state of health of the communities varies greatly with the state of the marshes. When the mouth of the Hindieh canal is freely open, the marshes are in fact an inundation with a currant moving steadily towards the Sea of Nedjef; when it is partially or wholly closed they may become stagnant swamps, the water of the canal being retained within the various irrigation channels.

The Hindieh marshes as observed from the summit of Birs Nimrúd, are thus described by Mr. Kennett Loftus (*Travels and Researches in Chaldæa and Susiana*) who visited the locality in 1854:—

"The view from the summit of the Birs Nimrúd is very extensive, and its utter desolation has been the theme of frequent observation. No one can stand there and survey the scene around without being struck with the literal fulfilment of Isaiah's prophecy:—'I will make it a possession for the bittern. 'and pools of water; and I will sweep it with the besom of destruction, saith 'the Lord of Hosts.' Spreading out like a vast sea upon the north and west is a marsh, which all the labours of the ancient and modern rulers of the country have never been able to subdue. In certain seasons the waters of the Euphrates rise above their ordinary level and flood the whole surface of the low lands of Chaldæa, confirming every word of the prophet.

"Bordering upon this marsh a few spots attract the eye and relieve the long level of the horizon. Due south stands the little tomb of the prophet Ezekiel, and at the distance of 50 miles, in the mirage of early morning, may be discerned the mosque of the sainted Ali, glistening like a speck of gold as the beams of the rising sun play upon its surface. Nearer at hand, on the north-west, are the twin domes of Kerbella, the burial place of Ali's slaughtered sons. The edge and islands of the marsh are at times dotted with encampments of Khuzeyl Arabs, and with the telescope may be distinguished their numerous flocks of sheep and camels, while the hum of busy voices can be distinctly heard a distance of full six miles across the waters.

"From the Birs Nimrúd southwards a road runs along the raised bank, which here in a measure restrains the marsh within bounds. A succession of large canal courses, now dry, are crossed during a ride of 12 miles to the little town of Keffil, which, from its want of luxuriant trees and vegetation, looks dull and sombre in the extreme, a fitting place for the sepulchre of a captive prophet in a strange land. There have been trees at some time or other, as a few stunted palms bear witness, but, like the town itself, they have witnessed more flourishing times. They are ludicrous specimens of their race, and stand with their branches projecting straight upwards into the air, giving them the appearance of gigantic brooms. . . ." (pp. 33–34).

". . . In order to reach Meshed Ali, it is necessary to cross the marsh; for this purpose boats are always to be procured at Keffil. They are heavy, clumsy vessels, constructed of Indian teak, about 40 feet in length, with high pointed prows and sterns, and flat bottoms, for enabling them to skim over the shallows. Each is guided by two nearly naked Arabs, one of whom manages the cumbrous and primitive rudder, while the other attends to a huge lug-sail, if such a term can be applied to a patchwork of every shape and colour, filled with innumerable holes.

"The stream flows, at the rate of four or five miles an hour, through a continuous rice field, which is prevented from being completely overflooded by means of dams constructed of stakes and reed matting. Sometimes, when the rise of the Euphrates exceeds its usual level, the country is a vast inundation. On such occasions whole families of Arabs, with their frail dwellings of reeds and tents, are swept away in a single night. These calamities are but too frequent. Upon a few elevated spots small mud forts serve as citadels for refuge in case of inundation or attack. The Arab inhabitants of these marshes are a fine manly race, and their noble forms are particularly striking. Their half-naked and deeply-bronzed bodies, nourished by scanty fare, show every muscle to advantage as they propel their vessels with long poles in the shallows against the wind or stream, dexterously running along the edge of the boat. The keffieh, or head-dress, is useless among these marshes, for the long, thick, streaming hair of the Khuzeyl Arab acts as the most natural covering, and is admirably adapted for keeping off the rays of the sun.

"In sailing along, every now and then we encountered a noisy party in a crowded boat, who gazed with wonder, not unmixed with alarm, upon the European fleet. All appeared life and activity around us in those fens, the men not languidly smoking their pipes like the dwellers in cities and loungers in bazaars, but busy at their daily employments, as agriculturists should be. The women were engaged about their tents with duties not less arduous than those of the stronger sex. Notwithstanding their labour and activity they are evidently in a wretched state of misery, and ground down by heavy exactions. . . ." (pp. 38–39).*

The same author writes of the Hindieh canal (which he suggests follows the line of the ancient Pallocopas), and of the Sea of Nedjef as follows :—

"The mouth of this interesting canal is situated about two miles below the Khan at Musseib, and about 16 miles above the commencement of the existing ruins of Babylon, at a point where the natural channel of the Euphrates makes a slight eastern bend. When greatly flooded the violence of the stream frequently breaks down the artificial barriers erected to regulate the influx of water, and enlarges the entrance of the Hindieh. Immense sums of money are expended by the Turkish Government in rebuilding, repairing, and strengthening the dam, because the river has a tendency to quit the Babylon channel and to flow westward into the marshes, as in the days of Alexander. The natural effect is to deprive the eastern side of the Euphrates of its due irrigation, by reducing all the canals below the point of bifurcation; the villages become deserted and the fields uncultivated. On the western side the rice grounds of the Khuzeyl Arabs are overflowed, and cultivation is entirely out of the question. The chief revenues of Baghdad being derived from these regions, it is of the utmost importance that the equilibrium of the two branches of the Euphrates should be properly cared for.

"Soon after the accession of Abdi Pasha to the government of the province, like all his predecessors, his attention was directed to this subject. The force of the stream, caused by the extraordinary rise of the river, had carried away every trace of the former dams, and enlarged the mouth of the Hindieh to such an extent that the Euphrates bid fair to disappear into the western marshes. He therefore cut a new channel, 120 feet broad, at a short distance above the bifurcation, which relieved the pressure and enabled him to effect the building of a new and strong dam of osiers, reeds, and earth at the mouth of the Hindieh, while the quantity of water admitted into the new cut was regulated by two solid brick piers with sluice-gates 80 feet wide.

"Notwithstanding all this expense and trouble, the river in 1854 overcame all obstacles, and once more regained possession of the marshes. Flowing

* Mr. Layard describes the scene late in 1849 from Birs Nimrud, looking towards the marshes, as follows:—"In the midst of the swamps could be faintly distinguished "the mat huts of the Kazail forming villages on the small islands. The green "morass was spotted with flocks of the black buffalo. The Arab settlements "showed the activity of a hive of bees. Light boats were skimming to and fro "over the shallow water, and women urged onwards their flocks and laden cattle." —(*Discoveries in the Ruins of Ninevah and Babylon.* 1853. p. 500.)

southwards a few miles a deep stream 180 feet wide, with banks 10 or 20 feet high, the Hindieh enters and is lost in the great inundation extending on the north and west of the Birs Nimrúd, passes Keffil and the ruins of Kufa, and ultimately debouches into the great inland fresh-water sea of Nedjef.

"No modern traveller has yet succeeded in following the entire course of the ancient Pallacopas, but traces of its channel are still visible on the east of the town of Nedjef.

"The great sheet of water, the Bahr-i-Nedjef, extends 40 miles in a south-easterly direction, and at its southern extremity gives out two considerable streams, Shat-el-Khuzif and Shat-el-Atchan, which subsequently unite, and are known by the latter name. Further to the south, five large bodies of water have their origin from the Atchan, and, uniting, constitute the Huran. This, after flowing about 30 miles, eventually joins the Atchan, and the two rivers form what is called the western or Samava branch of the Euphrates. All the above branches are navigable when the mouth of the Hindieh is open, and it is by them that merchandise is conveyed from Busrah to Hillah. When the great annual rise of the Euphrates occurs, the whole region from the Bahr-i-Nedjef to Samava is one continuous inundation, called the 'Khor Ullah,' or marshes of God. Here and there it is dotted with thousands of small islands, separated from each other by an infinity of streamlets. It was amid the innumerable channels of these *Paludes Babyloniæ* that Alexander was overtaken by a storm and all but lost during his sail down the Pallacopas.

"It is only when the mouth of the Hindieh is opened by the destruction of the dams that the modern traveller is enabled to see the *Paludes Babyloniæ* as Alexander saw them. When, however, the Hindieh is closed effectually for a time, the Khuzif and Atchan cease altogether to exist, and the town of Samava is supplied by two small canals derived from the Hillah branch of the Euphrates, near Diwanieh. Such was probably the case during the labours of the officers in the Euphrates expedition under Colonel Chesney, as the streams flowing from the Bahr-i-Nedjef are not laid down on any map. Instead of them, however, there is the course of an extinct river-bed passing east of the Bahr-i-Nedjef to Semava, which may represent the Pallacopas of Alexander in a portion of its course" (pp. 42–46).

Among certain of the villages amidst the Hindieh marshes, in 1867, after an excessive flood of the Euphrates and inundation of the marshes, plague which was believed to have disappeared from Mesopotamia for 33 years reappeared. The population of the Hindieh district at this time was estimated, officially, at 50,000, but the inhabitants of five villages only were ascertained to have been affected by the disease. The total inhabitants of these villages did not exceed 1,000, and the deaths among them from plague, it is believed, were not less than 300. The disease ceased in June. The symptoms of the malady, as summed up by one of the Sheikhs of the infected villages to Dr. Paduan, the Superintendent of the Ottoman Sanitary Administration in the pashalik of Bagdad, were, "ardent fever, intense thirst, delirium, swellings in "the parotids, in the armpits, and in the groins, then black circles "appeared upon various parts of the body, ending in sloughs." In one case investigated by Mr. Colvill, Surgeon to the British Residency, Bagdad, there had been bloody vomit; in another case seen by him, diarrhœa with bloody stools was stated to have been an early symptom.*

* Accounts of this outbreak of plague, from which several of the details in the text are taken, have been published by Dr. E. D. Dickson, the Physician to H.M. Embassy, Constantinople (*Transactions of the Epidemiological Society of London*, Vol. 3, Pt. 1, p. 143); by Mr. Colvill (Sanitary Report on Turkish Arabia, Transactions of the Medical and Physical Society of Bombay, 1871, p. 49); by Dr. Tholozan in two monographs (*Une Epidémie de Peste en Mesopotamie en* 1867, Paris, 1867, and *Histoire de la Peste bubonique en Mesopotamie*, Paris, 1874; and by Dr. Naranzi, Secretary to the General Board of Health of the Ottoman Empire (*Rapport sur l'Epidémie de Hindié dans l'Irak-Arabi, en* 1867). Dr. Naranzi, under instructions from the Board, visited the scene of the outbreak several months

Persian Kurdistan, 1871.

After this occurrence of plague in the Lower Euphrates nothing more was heard of the disease until the year 1871, when it appeared in Persian Kurdistan. This appearance was investigated at the time by Drs. Castaldi, Paduan, and Wortabet, the Ottoman sanitary physicians resident at Teheran, Bagdad, and Suleimanieh respectively, and by Dr. Schlimmer, of Teheran. These gentlemen were not able to penetrate into the more remote district where plague had first broken out, the surrounding communities refusing to allow them to pass and threatening them with death if they made the attempt. But they were enabled to study the disease at Bana and other places on the outskirts of the area which had become infected. Dr. Castaldi's official report of the results of his inquiry made to the General Board of Health, Constantinople, has been published;* and Dr. Schlimmer has also published an account of the results of his investigation.† After the cessation of the outbreak, the district which had been infected was visited, under instructions from the Governor of Georgia, by Dr. Telafous, the Quarantine Director at Akhalsikh, on the Russo-Persian frontier. He was able to visit every part of the district, including the villages where plague is believed to have been earliest developed. His inquiries substantially confirmed the information which had been furnished to Dr. Castaldi respecting the beginning of the outbreak.

Plague in this outbreak in Persian Kurdistan appears to have first shown itself at the end of autumn 1870 or the beginning of the winter of 1870–71, on an elevated table-land lying south-east of Lake Urumiah, between the head waters of the rivers Jagatu and Tatawa, both of which streams flow into the lake named. The district had last before suffered from plague in the epidemic of 1829–35. The villages attacked not only within the locality of first appearance, but also in neighbouring localities to which the disease extended, including the town of Bana (Berozeh), are according to Dr. Telafous built at altitudes above the Black Sea of which the lowest (Uchtepé) is 4,540 feet, and the highest (Arbanos, where the disease seems first to have become active), 5,870. Bana has an altitude of 5,470 feet; and Akjivan, where the nature of the disease was first recognised, is 5,240 feet.

The villages earliest attacked are situated in the district of Mikri. The disease is believed to have originated in a hamlet named Djoumou-

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after the cessation of plague, and as the results of the inquiry he then made, he came to the conclusion that that disease had not been plague, but a malarial typhoid fever, which he designated *typhus loimoïde non-contagieux*. He was chiefly influenced in arriving at this conclusion by the circumscribed prevalance of the disease, which he held to be inconsistent with a belief in the contagiousness which is considered to be one of the characteristice of *bubonic* plague. Dr. Paduan and Mr. Colvill, both of whom had visited the infected district before the disease had ceased, and had seen cases in various stages of its progress, were both convinced that the malady was bubonic plague. The opinion of Dr. Paduan on this subject has the weight obtained from a previous acquaintance with the disease, before its apparent cessation in Mesopotamia and elsewhere in the East. The unquestioned appearance of plague in a contiguous district of the Lower Euphrates in 1874, is regarded by the Ottoman General Board of Health, which had previously been doubtful on the subject, to be confirmatory of the conclusion arrived at by Dr. Paduan and Dr. Colvill. (See note to this effect in Dr. Castaldi's Report on Plague in Irak-Arabi, 1873–74, p. 38.)

* La Peste dans le Kurdistan Persan. Rapport du Dr. Castaldi, Constantinople, 1872.

† Contribution à l'Historie de la Peste en Perse, Par Joh. L. Schlimmer, Teheran (lithograph), 1874.

Dr. Tholozan has discussed this outbreak in a *Note sur le developpement de la Peste Bubonique dans le Kurdistan en* 1871, Paris, 1871; and again in his *Histoire de la Peste Bubonique en Perse*, Paris, 1874.

chan (Gamishan), which is situated at an altitude of 6,600 feet, and which at the time of the appearance of plague contained six families. When this hamlet was visited by Dr. Telafous he found but one family in it, and he simply observes with respect to it that "from the local "characteristics he could discover nothing which would explain the "origin of the disease, the springs of water being very pure, the "inhabitants few, only six families, mountain air and severe winters." Arbanos, three miles distant from Djoumouchan, is described by Dr. Castaldi as being situated in an unwholesome marshy district where rice is largely cultivated. This village contained 25 families, among whom there were 77 cases of plague, 65 of which were fatal. Akjivan, in the same neighbourhood, a village of 150 families, among whom there were 160 cases of plague, 130 fatal, is described by Dr. Telafous as "built on an argillaceous calcareous soil, possessing many excellent "springs of water, but without any vegetation near the houses, the "cultivated tracts lying some distance from the village as likewise the "graveyard. The lanes and alleys between the houses were full of "filth, which is however the usual characteristic of the Kurdish "villages. The houses are not crowded together, nor do the walls of "one abut on those of another." The following descriptions of other villages early attacked by plague may also be quoted from Dr. Castaldi's report, the altitudes, population, and extent to which affected being taken from Dr. Telafous's report. Kananias (altitude 5,550 feet, families 15, attacks 12, deaths 8), "is situated at the foot of the "mountain in a small arid plain, not far from the river Jagatu. The "village is formed by half-a-score houses leaning one against another, "with low and contracted doors and windows. Before these houses "are heaps of ordure of every kind, and also of sun-dried cakes of "cow-dung used for fuel, there being no wood in the locality. This "combustible is piled up all around the village to a height higher than "the windows, and it is stored also in layers on the roofs of the houses. "Whatever is most afflicting in poverty, whatever is most revolting in "filthiness is accumulated, as if designedly, around these infected dens, "in the interior of which live or rather vegitate from 50 to 60 indi-"viduals, men, women, and children. The cultivation of some plots of "ground in the neighbourhood furnishes these unfortunates with in-"sufficient nourishment." Of Karava (altitude 5,650 feet, families 20, attacks 40, deaths 32), another early infected village, Dr. Castaldi says: "All that I have said of Kananias is equally applicable to Karava. "The same misery, the same filthiness, the same crowding together of "houses. In half-a-score of these foul hovels, veritable burrows, live "nearly 100 people."

The spring of 1870 had been one of extreme drought, and in the course of the year a fatal epizootic had occurred among sheep and ergotism among the people. The district, it is stated, escaped the disastrous famine which had affected Persia, beginning in 1870 and continuing throughout 1871; but with preceding murrain and ergotism it may be doubted, notwithstanding the statement of the official reporter to the contrary, whether the inhabitants did not suffer from actual privation in the winter of 1870–71. During the winter deep snow fell, and the villagers being shut in intercourse with each other and with the surroundiug districts became impossible. Whilst the populations were thus snowed up, built in by the snow in the midst of the indescribable filth, peculiar to Kurdish villages, plague became active among the infected communities and almost extinguished several. When the spring enabled communications to be resumed between the infected villages and neighbouring villages and districts, plague spread

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On Levantine Plague, by Mr. Netten Radcliffe.

abroad over a relatively limited area. It extended as far south as Bana, but before the close of the year it appears to have died out.

The disease as observed by Dr. Castaldi and his colleagues was characterised by ardent fever, the appearance of bubos in the armpits and groins, and on the neck, the occurrence of carbuncles in various parts of the body, and of petechiæ scattered generally over it. In the villages it spread from house to house in succession, and among families from one member to another, in fatal cases running a rapid course of from two to four days.

I subjoin Dr. Telafous's statement of the villages and towns affected in this outbreak, and of the losses occasioned by the disease in them. Dr. Castaldi mentions other places not included in Dr. Telafous's list, and his account of the attacks and deaths do not correspond with Dr. Telafous's statement. But Dr. Telafous's information being in every instance obtained upon the spot is probably the nearest approximation to the truth.

—	Names of Villages, &c	Number of Families.	Number of Persons attacked by the Plague.		Distance in hours from Akjivan.	Height in Feet above the level of London.	Height in Feet above the level of the Black Sea.
			Died.	Recovered.			
1	Akjivan - -	150	100	30	—	6,150	5,240
2	Gamishan - -	6	7	0	¼	6,600	5,650
3	Arbanos - -	25	65	12	¾	6,720	5,870
4	Bibikend -	15	25	2	¼	6,500	5,650
5	Chahardowli - -	60	60	20	¾	5,850	5,000
6	Sarab - - -	100	6	1	1¼	5,900	5,050
7	Gök tepé -	25	10	0	2¼	Id.	Id.
8	Armeni boulak - -	200	125	20	2	Id.	Id.
9	Ak tepé - -	60	60	6	2½	6,000	5,150
10	Turcoman kendi -	50	130	20	3	6,150	5,300
11	Üch-tepé - -	200	200	50	3	5,790	4,540
12	Karava - - -	20	32	8	9½	6,500	5,650
13	Kananias - -	15	8	4	10	6,400	5,550
14	Bana (town) - -	400	63	56	20	6,320	5,470
	Total - -	1,326	891	229	—	—	—

1873-74.

After the appearance of plague in 1870-71 in Persian Kurdistan, vague rumours of the occurrence of the disease in Kurdistan from time to time gained currency in the East. None of these rumours were confirmed, but in the winter of 1873-74 and spring of 1874 the disease broke out in three localities widely separated from each other. It appeared in December 1873 among the Affij Arabs, occupying the marshes extending north and east of Diwanich on the east bank of the river Euphrates, nearly opposite the scene of the outbreak of 1867. About the same time the disease appeared in North Africa among certain tribes of nomadic Arabs then encamped on the Cyrenaic plateau, in the province of Bengazi (Tripoli), within the area of the outbreak of 1858. A little later, if not contemporaneously, it broke out in the Assyr country, Western Arabia.

1873-74.—The Lower Euphrates.

On the east bank of the river Euphrates, opposite the southern extremity of the district occupied by the Hindieh marshes on the west bank, is the "Mighty Marsh," inhabited by the Affij Arabs, the first of a series of great marshes which extend to the junction of the

Euphrates with the Tigris. Opening into the northern portion of this marsh is the Dagarra Canal, a great irrigration channel of which the neglected and ruinous ramifications doubtless contribute to the formation of the Marsh. When the river is in flood the water pouring through this canal converts the marsh and the adjacent country with an extensive inundation. What has been said of the Beni Taraf Arabs and their habitations, means, and food, in the Hindieh marshes, applies equally to the Affij Arabs.

The following extracts are from Mr. Layard's description of the marsh occupied by the Affij Arabs. He visited the tribe at the beginning of 1850, approaching their district from the north :—

"We now came to the borders of those marshes which have now spread over the lower part of the Mesopotamian plains. As we ascended the lofty banks of ancient canals, over which our track continually led, we saw a boundless expanse of dark green, mottled with shadows by the wind, like the ruffled surface of a lake. It seemed as if the parched desert had been suddenly turned into pastures and fields of green corn. But we only gazed upon a vast bed of tall reeds bred by the wide spreading swamps, no less a sight of desolation, neglect, and decay, than the yellow wilderness. . . .

"We had sent one of our Affaij guides to inform Sheikh Agab of our approach. I had not been long seated in my tent when suddenly a number of black boats, each bearing a party of Arabs, darted from the reeds and approached the shore. They were of various sizes. In the bottom of some eight or ten persons sat crouched on their hams; in others, only one or two. Men standing at head and stern, with long poles of great lightness, guided and impelled them. The largest were built of teak wood, but the others consisted simply of a very narrow framework of rushes covered with bitumens, resembling probably 'the vessels of bulrushes' mentioned by Isaiah. They skimmed over the surface with great rapidity . . . .

"The tirada in which I sat was skilfully managed by two Arabs with long bamboo poles. It skimmed rapidly over the small lake and then turned into a broad street cut through green reeds, rising 14 or 15 feet on both sides of us. The current where the vegetation had thus been cleared away, ran at the rate of about two miles an hour, and as we were going towards the Euphrates was against us. We passed the entrances to many lanes branching off to the right and to the left. From them came black boats filled with Arab women carrying the produce of their buffalo herds to the Souk or market. As we glided along we occasionally disturbed flocks of waterfowl, and large kingfishers of the most brilliant plumage seated on the bending rushes watching their prey. Herds of buffalo here and there struggled and splashed among the rushes, their unwieldy bodies completely concealed under water and their hideous heads just visible upon the surface. Occasionally a small plot of ground, scarcely an inch above the level of the marsh and itself half swamp, was covered with huts built of reeds, canes, and bright yellow mats. These were the dwellings of Affaij, and as we passed by troops of half-naked men, women, and children issued from them, and stood on the bank to gaze at the strangers." (*Discoveries in the Ruins of Ninevah and Babylon.* 1853. pp. 549, 551–553.)

Mr. Kennett Loftus, who visited the Affij Arabs in 1854, thus describes the same marsh and its occupants :—

"We had now reached the commencement of those immense marshes which extend almost uninterruptedly to the Persian Gulf, and which, as I have previously said, cause the country under their influence to be a complete *terra incognita*. The swamps occupied by the Affej Arabs stretch, during the low season. from the Euphrates on the west, into the very heart of the Jezireh, and in some places even join those of the Tigris. It is impossible to state their area; but it is calculated that they support a population of 3,000 families, who pay an annual tribute of 100,000 piastres (about 900*l.*) to the Pasha of Baghdad. Abdi Pasha, however, thinking they were able to bear a considerable increase of taxation, proposed to double the above sum for the following year. The Affej were in no small state of fermentation and alarm, complaining

bitterly of he treatment they had at various times received from the authorities of Baghdad. Nedjib Pasha had thrice blown their fragile towns about their ears with cannon. These consist entirely of reed huts, the reeds being tied in large bundles and neatly arched overhead. This primitive construction is covered externally with thick matting impervious to rain. The riches of the Affej are indicated by rows of huge reed cylindrical baskets, containing the grain upon which they subsist. Rice is produced in great abundance along the edges of the marsh; but the whole of their fields were, at the season of our visit, and for a third of the year, entirely under water. Communication is kept up as on the marshes of the Hindieh, by means of long, sharp, pointed terradas, constructed of teak, and measuring twelve or fourteen feet long, by a yard in width. The Affej tribe is divided into two nearly equal parts, governed by two brothers, Aggab and Shkyer, the former being the accredited head of the whole."—(*Chaldæa and Susiana*, pp. 91–92.)

Plague was first observed at the end of December 1873 in the village of Dagarra, and the corpses of those who died earliest from the disease were carried to Nedjef for burial. The disease extended to others of the Affij villages, and in April attacked Diwanieh. Afterwards it spread irregularly in the district on the west bank of the river, intervening between that town and Hillah on the north, and Kerbella and Nedjef on the west, overlapping in short the scene of the outbreak of 1867.

This outbreak was investigated for the Ottoman General Board of Health by Dr. Castaldi, and his report of the result of his investigation has been published by that Board.* Dr. Castaldi estimates the population of the infected district to have been 80,700, and the deaths from plague during the three months April, May, and June 1874 to have been 4,000. Of these deaths upwards of 2,000 took place in Dagarra and the surrounding villages of the Affij tribe, of which the population is estimated at 35,000. The following table is constructed from the data given by Dr. Castaldi:—

Towns and Districts.	Population.	Time of Prevalence.	Stated Deaths.	Remarks.
Dagarra, with Haffytch and the villages of this district.	35,000	Dec. 1873—June, 1874.	2,000	—
		1874.		
Diwanieh district -	6,000	13 April—9 June	194 600	Probably 1,200 deaths.
Hillah - -	20,000	13 May - -	5	—
Sultan Mansour and Djerbolá.	1,500	17 May—13 June	82	—
Hum-el-Bahrour -	1,500	- - - -	8	All imported cases among a body of police.
Tueritch - -	2,000	10 May - -	1	—
Nedjef - -	4,000	1 May - -	22	Deaths among Persians unknown.
Midhadieh - -	700	April—May - (18 days)	120	—
Kerbella - -	10,000	25 June -	3	—
		State total deaths -	3,035	
		Estimated deaths -	4,000	

* La Peste dans l'Irak-Arabi en 1873–74. Rapport du Dr. Castaldi, Dèlègue Sanitaire en Perse. Constantinople, 1875.

Discussing the distribution of the disease Dr. Castaldi especially draws attention to the exemptions of Hum-el-Bahrour, Nedjef, and Kerbella, notwithstanding introduced infection, especially in the first-named place, and the presumably favourable conditions existing in the two sacred cities for the maintenance and diffusion of infectious maladies. He also comments upon a peculiarity of the symptoms, particularly as observed at Dagarra (these in other respects not differing from the symptoms observed in the outbreak of 1870–71 in Persian Kurdistan), namely, frequent bloody vomit at the beginning of the disease, the cases thus affected dying within 24 hours, before the development of buboes. Bloody vomit has been noted in the case of plague recorded by Mr. Colvill during the outbreak of 1867. This sympton is not mentioned in the account of the outbreak in Persian Kurdistan, but it will be again noted in the outbreak of the year under consideration in the province of Bengazi, about to be described.

1874.—Bengazi Province.

The outbreak of plague in the province of Bengazi, in 1874, was investigated by Dr. L. Arnaud, one of the physicians in the service of the Ottoman General Board of Health, and a detailed report of the results of his inquiry has been published by the Board.* The disease appears to have been limited solely to the nomadic Arabs frequenting at the time of its appearance and prevalence the Cyrenaic plateau. The existence of plague was first observed in April 1874, but Dr. Arnaud is of opinion that cases had occurred several months before. The outbreak had been preceded by three years' privation arising from failure of crops in the successive years consequent upon persisting drought. In the winter months of 1873–74 the famine had become so severe that persons might be seen hunting for undigested grain in the dung voided by camels. The cold season of 1873–74 and spring of 1874 had been unusually wet and had converted some of the favourite camping grounds of the nomadic tribes, as in the valley of Merdj, into swamps, adding to the misery of the starving population for the time being, but rendering secure the summer crops. Mr. F. Henderson, H.M. Vice-Consul at Bengazi, who had passed through Merdj in April, states that he found there "the greatest "misery, the wretched inhabitants subsisting principally on wild "artichokes, and the village was almost unapproachable owing to the "continuous rains having converted the plain on which the village is "situated into a vast marsh." He states also that the famine which had followed upon the long-continued drought had decimated the population of Bengazi and the Bedouns of the plain; and that it was no uncommon thing at this time to find in the morning three or four corpses in the streets of Bengazi of persons who had perished miserably over night.†

At the crisis of misery, as it were, plague appeared in a diffusive form, and spread from encampment to encampment and to certain of the villages and monasteries in the highlands, but not to the two towns of the littoral or apparently to the tribes in the low-lying plains. Dr. Arnaud was able to follow the movements of the disease in some detail noting its dissemination through the inter-communication of the occupants of various encampments, and showing a period of latency after exposure to infection in three cases of 5 days, in one case of 6 days, and generally a limit of 8 days.

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* Essai sur la Peste de Benghazi en 1874. Rapport du Dr. L. Arnaud. Constantinople, 1875.

† Letter to *The Times*, 19th August 1875.

App. No. 7.

On Levantine Plague, by Mr. Netten Radcliffe.

In this outbreak, as in that among the Affij Arabs previously described, bloody vomit and a blackish vomit are described among the early symptoms. Buboes and carbuncles were almost invariably observed; petechiæ generally; boils rarely. The fatal cases ran a rapid course of from two to four days.

The following is Dr. Arnaud's tabulated summary of this outbreak :—

Tribes and Localities.	Beginning and Duration of Disease.	Population.	Attacks.	Deaths.	Recoveries.	Free from Seizure.
Orphas - -	5 April—1 month -	34	10	7	3	24
Ferig-el-Hassan -	7 April—4 months	62	55	22	33	7
Kefauta - -	17 May—1½ months	75	50	25	25	25
Environs of Kefauta	22 May—1 month -	57	39	17	22	18
Merdj - -	28 May—2 months -	310	270	100	170	40
Segha - -	1 June—1 month -	3	2	2	—	1
Toukra - -	3 June—2 months -	16	13	6	7	3
Aït-Zekri - -	12 June—2½ months	32	29	11	18	3
Aït-Brakta -	Do. do.	33	27	7	20	66
Aït-Ahmet-Kmćil -	15 July—2 months -	38	31	11	20	7
Aït-Abides -	24 July—1½ months	74	7	0	7	7
		734	533	208	325	201

Dr. Laval, a French Army Surgeon, resident at Bengazi, and who had observed the plague there in 1858, visited Merdj at the request of the Governor of the province, early in the outbreak, in order to ascertain the actual character of the disease which had manifested itself in that place, and of which the nature was then doubtful. In the course of his investigation, which made it clear that the malady was true bubonic plague, he unfortunately contracted the malady and died after a very short illness.

1874.—The Assyr Country, Arabia.

The outbreak of plague in the Assyr country, North Yemen, Western Arabia, in 1874, was investigated by Dr. Pasqua, the Inspector of the Ottoman Health Department at Jedda. He started inland upon his mission, from the port of Confoda, early in September, travelling by way of the villages of Halli and Mikaiel. The following is a summary of the results of his inquiry, as given by Dr. E. D. Dickson in a letter dated 12th February 1875, addressed to Her Majesty's Ambassador, Constantinople, and which contained the substance of a report on the subject by Dr. Buez, the French Vice-Council at Jedda, communicated by the Ambassador for France at Constantinople to the Ottoman General Board of Health :—

" Constantinople, Feb. 12, 1875.

" Towards the end of July 1874 Dr. Pasqua, inspector of the Health Department at Jeddah, was informed by the Governor-General of the Hedjaz that a malady resembling the plague prevailed at 'Doga,' a village containing from 200 to 250 inhabitants, placed at the foot of the 'Assyr' mountains, one day's march S.E. of Leeth, and four days S. of Mecca.

" A little later, on inquiry, Dr. Pasqua found that it was not at Doga that the outbreak had occurred, but among the 'Beni Sheir,' a tribe inhabiting the table-land of the Assyr.

" As soon as this was ascertained measures were taken by the Governor to prevent the infected locality from communicating with the healthy, and a quarantine station was established at 'Bin-Omar,' about three hours distance from Mecca. All maritime arrivals from the coast of Yemen were put into five days' quarantine at Jeddah, and were subjected to a medical inspection before receiving pratique. Inquiries were, moreover, addressed to the Medical

Superintendent of the military hospital at Mikaiel, the garrison station of the district, for information regarding the malady; and in the beginning of September, Dr. Pasqua went to Confuda, and from thence proceeded into the interior, in order to visit the seat of the outbreak.

"Confuda the principal port of Yemen, and Halli, a village beyond it, as well as Mikaiel, were all perfectly healthy; and the 80 patients lodged in the military hospital there presented no symptom whatever of any contagious or epidemic disease.

"On leaving Mikaiel the land gradually rises as you advance towards the 'Sinan' mountains, whose summits attain a very considerable elevation, and it is on the slopes of these mountains that the Assyr population dwells.

"The Assyr country, properly so called, is therefore between Nejd, Hedjaz, and Yemen. It is a vast territory covered with mountains extending from the 17th to the 20th degree of N. latitude, bounded on the N. by the torrent of 'Tabalah,' on the N.E. by that of 'Bysheh,' and on the S.W. by the Red Sea. Its population is reckoned at 60,000, a warlike race, subdued for the first time by the Turks in 1870.

"The lowlands are called 'Tehama,' a name also applied by the Arabs to denote the sandy plains extending between the Red Sea and the mountains all the way from Akabah to Aden.

"That part of the Tehama traversed by Dr. Pasqua offers a poor aspect, and its villages are mean, consisting of mud huts. Even Halli and Mikaiel, the two most populous, present a wretched appearance. The hospital at Mikaiel, however, is well kept. The 'Beni Sheir' are part of a tribe of 800 to 1,000 souls, spread over the Assyr mountains in encampments distant 10 or 12 days S. from Mecca, six days S.E. from Confuda and Leeth, and only three days from Mikaiel.

"The outbreak commenced about the end of March 1874, and continued in a *sporadic* form until the middle of July, when it became violent, and raged epidemically during the remainder of that month and the month of August, and assumed a decidedly contagious and spreading character.

"Such of the natives as had seen the *Plague* of 1853, which had committed great havoc in Arabia,* declared the present outbreak to be the same disease. The first locality attacked was the village of 'Ali-Saadi,' inhabited by 325 persons, of whom 100 perished within six weeks, viz., 40 men, 25 women, 15 boys, and 20 girls. The next village visited by the malady was that of 'Ali-Dogmain,' composed of 500 souls, of whom 50 died, viz., 10 men, 12 women, 20 boys, and eight girls. At the same time the village of 'Dogmain,' of 715 inhabitants, was attacked, giving a death-rate of 30, viz., eight men, six women, 12 boys, and four girls. Then followed the village of 'Ali-Marabi,' containing 210 persons, which gave 40 deaths, viz. 12 men, eight women, eight boys, and 12 girls, and so on.

"Most of these villages are situated on an elevated table-land called 'Toumouna,' rising about 2,000 metres above the sea and 1,500 above the 'Tehama,' and extending as far as the 'Namaz' range, from which it is separated by the valley of 'Waba.'

"Here a marked contrast is seen between the barren, wretched plain of Tehama and the fertile, pleasing aspect of the Toumouna plateau. The villages just named are built of stone; the houses have several stories, are well-aired and properly distributed; and the soil is rich, and produces the best quality of Yemen coffee, often giving two crops in the same year. Indian corn, dhurra, barley, and indigo are cultivated; vegetation thrives and fruit trees abound. Running water is scarce, but in lieu of it the inhabitants are supplied with wells and cisterns.

"The low country, on the other hand, is sterile and marshy, and has an elevated temperature. Dr. Pasqua's thermometer indicated there 36° (Reaumur?), while on the plateau it fell to 14°, and the air felt keen and chilly. Malaria fevers are absent in these elevated regions, and the prevailing complaints have a catarrhal tendency.

"The outbreak prevailed at first on the plateau of Toumouna, from whence

* Dr. Buez, in a paper on the subject published in the *Gazette Hebdomadaire de Médecine et de Chirurgie* (1875, p. 52) says, in reference to this point, "Pour les "habitants qui avaient observé cette maladie en 1816, puis en 1853, où elle avait "fait d'assez grands ravages, cétait la peste bubonique.'"

it extended to that of Namaz, and even went beyond it as far as within four days' reach of Mecca. It then retraced its course and died out to the village of Namaz.

"When Dr. Pasqua visited Namaz on the 20th Sept. he only saw five cases of the malady, all more or less in a state of convalescence, yet as they were all marked with characteristic glandular swellings, he concluded it to have been the plague.

"The village of Namaz is composed of 46 houses, containing a population of 280 inhabitants, and a garrison of 135 zaptieh (police force). The Kaimakam (Lieutenant-Governor) of the district resides here, while the Mutessarif (Governor) of the Assyr lives at Mikaiel.

"On quitting Namaz Dr. Pasqua left there Dr. Agop Effendi, who had been detached from the hospital of Mikaiel for this purpose, and after returning to Jedda he was informed by the Vali (Governor-General) of Yemen, who had made a tour of inspection in the Assyr, that the outbreak had entirely ceased. This news was, moreover, confirmed by a report from Dr. Agop Effendi dated on the 22nd October, on the receipt of which by Dr. Pasqua the quarantine applied at Jeddah and Mecca on arrivals from Yemen was removed.

"The public health at Mecca was carefully watched all the while. No untoward event occurred there, either amongst the natives or amongst the pilgrims.

"On former occasions plague visited the Beni Sheir, viz., in 1816 and in 1853. In 1816 it was brought there by the Egyptian army, but to that of 1853 no origin has yet been assigned, and Dr. Pasqua believes that the late outbreak is due to a like cause, and he discards the idea of its importation from elsewhere, because the inhabitants of these elevated regions do not mingle with those of the lowlands, and, being Wahabbis, are thus excluded from intercourse with the true believers."

To this interesting account Dr. Dickson adds a remark made by Dr. Parznichi, in a report to the Central Health Department, dated from Djerzan, in Arabia, on the 18th December 1874, that "the localities "lately attacked by the outbreak of plague had been previously visited "by famine."

1875.—The Lower Euphrates.

On the 24th March 1875, Dr. Paduan telegraphed from Bagdad to the General Board of Health, Constantinople, that several fatal cases of plague had occurred at Diwanieh, on the Lower Euphrates, "since the "month of December." As already related, Diwanieh was within the district in which plague had been prevalent in the spring and summer of 1874, and the town had then suffered somewhat severely from the disease. On the 12th April, Dr. Paduan again telegraphed to the Board that two days before cases of plague had been seen by a military medical officer stationed at Samava, South of Diwanieh, while on a tour of inspection, in a place called Umulnidjrin; and also that the Mutessarif of Hillah had reported that the disease had spread to Shinafieh, on the eastern border of the Bahr-i-Nedjef. A cordon sanitaire had been place round the district of Samava, and the huts in which the cases had occurred at Umulnidjrin had been burned. Dr. Paduan added an expression of opinion that this appearance of plague was a continuation of the previous year's outbreak.

The cases of plague reported in the district of Samava and the appearance of the disease at Shinafieh were the commencement of an extension which spread over the districts, on both sides of the Euphrates, immediately south of those which had been affected in 1874. On the west bank of the river the malady spread throughout the district lying between the stream and the Sea of Nedjef; and on the east bank it spread throughout the district which lies in the angle formed by the Shat-el-Hai and the Euphrates, and along the whole course of the river Hai to the Tigris. This district is inhabited by the Montefik Arabs. The disease appears to have occupied a wider area in 1875 than in 1874, but the mortality it occasioned in the first-named year as compared with

the last-named year is not yet known. Immediately on the news of the appearance of plague in the Samava district reaching Constantinople, the General Board of Health there gave instructions for a medical commission to proceed from Bagdad to the infected district. The *ad interim* reports only of this commission have as yet been communicated to this Department. Surgeon-Major Colvill, attached to the British Residency at Bagdad, under instructions from H.M. Consul-General and Political Agent there, also visited the infected district. I append in a note so much of the report prepared by Mr. Colvill on the results of his visit as is necessary for the purpose of this memorandum. The report is of peculiar interest and value from the account it gives of the localities traversed on the Euphrates and the state of the river between Lamlum and Samava, and for the information it contains regarding the prevalent disease.

In December 1875 a few cases of a bubonic malady, presumably plague, were reported by the Sanitary Administration at Bagdad to have "occurred at Azizie, near It Hané," on the Euphrates.

At the beginning of the present year (1876) plague again became active in Mesopotamia. The re-appearance of the disease there was announced in the third week of February; but the disease had been present in that town on the 1st January, one death from it having been recorded on that day, and not less than 50 deaths from that date to the close of the month. A telegram from H.M. Representative at Constantinople to the Principal Secretary of State for Foreign Affairs, dated 17th March 1876, states "that plague is increasing in Mesopotamia "and that there have been five cases in Bagdad itself."

1876.

Note.

Report by Surgeon-Major Colvill to H.M. Consul-General and Political Agent, Bagdad, on Plague in Mesopotamia, 1874–75.

Mr. Colvill on Plague in Mesopotamia, 1874-75.

"Bagdad, June 5, 1875.—I have the honour to report my progress along the Euphrates in search of plague. In order to make myself understood it will be necessary to give some account, but so far only as my present object is concerned, of the line of country travelled (for it is practically unknown to us), and if possible to append a rude plan, for all the maps I have seen are not only deficient, but misleading; towns are marked in large characters which have now no existence, while other towns have risen which have no place on the map; large canals with extensive permanent lakes which have existed of old are a blank, and the Euphrates is traced on these maps as a large river to its junction with the Tigris, while it actually disappears between Diwaniyah and Samawah.*

"In this description of the country I will divide my route into sections from one central town to another, the first being from Bagdad to Hillah. With reference to the subject under consideration one point only in this section requires notice, and it is this, that at Musseyib, 30 miles in a straight line above Hillah, a canal leaves the right bank and carries off half the water of the Euphrates. This canal is called the Hindeah, and passes through a district having Kerbella to the west and Hillah, with the ruins of Babylon, to the east, and at Meshed-Ali (Nejef) it opens into an inland sea, 60 miles long by 30 broad, called the Bahr-il-Nejef. It was in the marshes to the west of this Hindeah canal that the plague appeared in 1867. The water in the Sea of Nejef becomes brackish, and issues by a canal or river called the Shat-il-Shinafeah, which, after taking a southerly direction for about 20 miles,

* I have substituted for Mr. Colvill's rough map, a map based on actual survey.—J. N. R.

branches into two, the southern branch, the one used for navigation, being called the Atshan, while the other one is called Aber-Rufoosh, and both open into the Euphrates a little above Samawah. On the right bank of the Shat-il-Shinafeah, and within sight of the dome of Meshed Ali, stood the village of Shinafeah, to be afterwards mentioned. Most of the Mahomedan pilgrims from India to Kerbella and Nejef follow up the Euphrates, the Atshan, and the Shat-il-Shinafeah, and I saw vessels of 50 tons passing.

"My second section is from Hillah to Diwaniyah. During the first two-thirds of the way by river a number of canals, varying from seven to ten yards in width, open from both banks, and end in separate small marshes. Those opening from the left bank, in the order from Hillah, are: 1, Wurdieah; 2, Rumeah; 3, Abu Hassan; 4, Fanarah; 5, Be Rumanah; 6, Lanadal; 7, Shomlie; and, 8, Abu Chumach. Those from the right bank, in the same order, are:—1, Michereah; 2, Homaneah; 3, Alach; and, 4, Jerboeah. All these canals are farmed from Government by merchants in Hillah, and the cultivators reside permanently in Hillah, and live only by the canals in tents or reed huts while they grow the wheat and barley. No more canals open from the right bank of the river, but one-third from Diwaniyah, and therefore two-thirds from Hillah, on the left bank, is the opening of the Dagarah canal. This canal is 60 to 80 yards wide, and of considerable depth, and runs almost due east for 12 miles to the foot or enclosure of Dagarah. Its banks are some feet higher than those of the Euphrates, and there are numerous cultivators on both sides, who have to raise the water for irrigation in skin buckets drawn by horses or oxen. Their habitations being close to the canal are therefore on dry ground. At the fort of Dagarah the canal divides into three or four, but these quickly give off branches which run over ground lower than the surface of the water. This ground is used for the cultivation of wheat, barley, or rice, and the cultivators, who are all permanently settled, occupy reed huts built on ground saturated with moisture. Eight miles more and these waters again collect into a reed-bearing marsh, 22 miles long and 10 broad, but with a large space of open water in the centre. At the eastern end this marsh forms minute canals, which quickly join, becoming larger and fewer till at the village of Afiche they form one large canal, called the river Micherie. This is the district of Afiche. As at Dagarah, its ground is lower than the surface of the water, and its inhabitants permanently dwell in huts built on ground saturated with moisture. Twelve miles along the river Micheri is the village and small district of Abdare, exactly of the same nature as regards cultivation, irrigation, and habitation as Dagarah or Afiche. And now the canal takes the name of the river Karr, and bends round, as may be seen on an ordinary map, and opens into the Euphrates a little above the opening of the Shat-il-Subil (Shat-il-Hai). These canals closely resemble the arterial system; the Dagarah canal bearing the muddy water of the Euphrates represents the artery dividing and subdividing, while the marsh is the capillaries, for here all the mud is deposited, the water becomes perfectly clear, but acquires a deep black tint from the carbon of decayed vegetation and a strong marshy flavour; the river Micheri, which carries off the water, is of course the vein. A process something of this nature also happens in the Sea of Nejef, and it will be seen that almost all the solid particles of the whole of the waters of the Euphrates are precipitated before that river joins the Tigris, but what it gains in clearness it loses in flavour and quality. Six miles above Diwaniyah, at a place called Abu Fadal, another canal, 30 yards wide, opens from the left bank of the Euphrates, and runs in a south-easterly direction through the intermediate ground between the river Karr and the Euphrates. After a course of about 30 miles it opens into a marsh, and here is the village of Fowar, with its surrounding marsh district. As to cultivation, irrigation, and habitation, Fowar is the same as Dagarah or Afiche. The water of this canal is nearly all absorbed by marsh and cultivation, but a small stream from the marsh opens into the Euphrates between Samawah and Al-Khudhr. The town of Diwaniyah, built almost entirely of sun-dried bricks, is situated on both sides of the river which is crossed by a bridge of boats. The population is about 2,500, consisting, besides the government officials, chiefly of shopkeepers for the supply of the surrounding villages, and of agents for the purchase of wool and grain. There are besides two regiments of infantry, a battery of artillery, and usually a regiment of cavalry, said to be necessary in order to collect the revenue.

My third section is from Diwaniyah to Samawah. From Diwaniyah, half-way to Samawah, the country is without a tree, without cultivation, without a canal leading off, save one, and that very small, in the direction of Fowar, with no brushwood thicker than the finger or more than 2½ feet high, and not an inhabitant, save a few tents, 200 in all, of black hair of the Garoul. These are Bedowins who wander about on both sides of the river, and though they will not condescend to till the ground, they carry the grain from the country to town on their numerous camels. At this half-way, however, two miles inland from the right bank, is the solitary tomb of Humza, a son of Kauthem. Not a soul lives near it, but there are four guardians appointed, who take it week about to watch the tomb. A little further on, however, on the left bank, is the village of Humza. This is quite a recent place, consisting of 80 houses on dry ground, and from this cultivation begins, but the bank being high irrigation has to be performed in skin buckets drawn by horses. Surah, Antakiah, and Lamlum, towns marked on the map, have ceased to exist. There were two Lamlums, one, on the right bank, said to contain 10,000 inhabitants; probably true, for the ruins are extensive, but it was destroyed 44 years ago by the plague. The remaining inhabitants fled to the left bank and founded the second Lamlum, which, 15 years after, was also deserted as the river altered its course. These people then divided, the smaller portion forming a village on the left bank called Um-Nejeris, within sight of Jawariyah, marked on the map, while the majority founded the town of Rumoetha, nearer to Samawah, and also on the left bank. Before reaching Um-Nejeris the banks became low, and the water, when I was there, was pouring, as it does all the spring, over rice fields as far as one could see, and Um-Nejeris itself is a village of exactly the same stamp as Fowar or Afiche.

Jawariyah, however, is different, being built on a strip of dry land comparatively high. Rumoetha is a small but well-built town, with a good bazaar, and 300 houses, on a dry situation, comparatively high, and it is surrounded by gardens, which show that the subsoil around is not so damp as to rot the roots of trees. From Rumoetha to Samawah it is nothing but rice fields and marsh, with many little villages of reed huts on the drier ground. But be it remembered that all these villages are shifted twice a year, for so soon as the water falls the huts are all carried to the rice fields, and there remain till next spring rise, which completely washes and cleans the ground occupied by these villages during the greater part of the year. So great is the drain for the rice fields, that 20 miles below Rumoetha, at a place called Abu Chelib, the demand for water is greater than the river Euphrates can supply, and a back current sets in with force, this being the brackish water from the sea of Nejef, through the Shat-il-Shinafeah and the Aber Rufoosh. So that, in fact, the great river Euphrates is lost in the rice fields at Abu Chelib. The Aber Rufoosh and Atshan having joined a large river with comparatively high banks leads to Samawah. Samawah is a town of 3,500 innabitants, built on both sides of the river; it is, in fact, a duplicate of Diwaniyah, with this exception, that there are a number of gardens about it, and only 300 infantry and two guns.

My fourth and last section is from Samawah to Sook-il-Shiook, close to where the Shat-il-Hai opens into the Euphrates, and on the same side is the new town of Nassreah, founded five years by Nassr Pasha, chief of the great Montefik tribe, in order to perpetuate his name. For half the way from Samawah to Nassreah the banks of the river are comparatively high, and irrigation has to be carried on by skin buckets, the inhabitants remaining on the ground only during the growing season, and for the rest of the year living in Samawah and Al Khudhr.

Al Khudhr is a mud-built village of 200 houses, high and dry on the left bank. It surrounds the tomb of Khudhr, a son of Kathem. For the other half of the way to Nassreah, the country on the left bank is a swamp partly from the Euphrates and partly from the Shat-il-Hai. On the right bank it is a desert, and the only building to be seen is a domed room, built for the prophet Jonah, who is supposed to visit this earth two or three days every year, and having been once seen here it is supposed he may return, and the room is built for his reception. Within sight of this room I was caught in a storm. It had been calm all day, but towards evening a speck appeared in the north-west, which increased alarmingly fast. Clouds of dust rolled over clouds, and as they passed to the left took the form of ranges of hills with very bold fronts chasing one another.

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Mr. Colvill on Plague in Mesopotamia, 1874–75.

The boatmen, alarmed, ran their canoe into a niche in the bank; the sun disappeared; still scarcely a breath of wind. Presently there was a noise like the sea; not a roar, but the rattle of waves on the beach, and the storm came in earnest. It quickly passed, and settled into a squally night. It was probably a gust of this kind which swamped the steamer "Tigris" in Colonel Chesney's time. The town of Nassreah, of about 3,000 inhabitants, was planned by a Belgian architect. The streets are wide and parallel, or at right angles; all the houses are of mud, except the barracks, containing also the Government officers and the house of the chief. The Shat-el-Hai is a canal of the olden time, but it differs from all the other old canals that led from the Euphrates to the Tigris in so far that its openings at the Tigris and at the Euphrates are on the same level, so much so that the current in the canal is changed with any sudden rise of either of the rivers. The Shat-il-Hai, opening from the Tigris at Kut-il-Amarah, retains its name from the first third of its way, but during the middle third it divides into two, the easterly branch being called the Shat-il-Amah, and the westerly Abu Jeheirat. These two again join, and for the last third the canal is called Shat-il-Subī. Hai Wāsut, with the district round, contains 4,000 souls, and is situated on the Shat-il-Hai, 25 miles from Kut-il-Amarah. It is built partly of mud, and partly reed matting. Jelat Sekker, a village with its district, contains 2,000 inhabitants, and is situated on the Abu Jeheirat. The village of Shatra, with its district, contains 6,000 souls, and is situated on the Shat-il-Subīl. These three villages, partly of mud and partly of reed matting, are of the same class as regards position, cultivation, irrigation, and habitation as Um-Nejeris and Fowar. Three years ago Nassr Pasha attempted making an embankment along the right bank of the Euphrates from Nassreah to Busreh, in order to prevent the country to the south being flooded; the idea was grand, but no one having the slightest notion of the force of water, with the first rise of the river the embankment disappeared, and the Arabs who were forced to work at it fled to the Shat-il-Hai, and placed themselves under the mild rule of Fahad Pasha, brother of Nassr. This is worth noting, for if plague attacks them on the Hai, they may return to their old haunts. Sook-il-Shiook, or the bazaar of the chiefs, contains 2,000 inhabitants, and is a dirty, tumble-down place of sun-dried bricks. Its chief feature is a long bazaar, which contains nothing unless the daily wants of a poor people. Sook-il-Shiook is said to be falling into decay since Nassreah was built, and so dirty is it that the sooner it becomes a thing of the past the better for its inhabitants. It is about 16 or 20 hours by boat from Busreh.

Having finished the outline of my route, so far as it has reference to the subject of this letter, I shall now sketch the progress of plague. In the spring of 1874, plague appeared amongst groups of huts in Dagarah and Afiche, and it was imported from there into Diwaniyah, where 400, including the Governor's son, out of a population of 2,500, died. At the same time it appeared in Shinafeah, but whether spontaneously or by importation I cannot say. Last spring a man arrived from Afiche at Um Nejeris, and died in a hut of plague; and two to three days after his arrival, the first case of plague occurred. Four people in that hut died, all who fell ill, leaving two only untouched. In all, 20 people in a population of 500 died, and some 20 recovered. The heats having set in, the disease became dormant till last autumn, when it again appeared at Um Nejeris, and four persons died, but the greater number recovered. Plague again became dormant till the beginning of January of this year, when it was reported to exist on the Shat-il-Hai. In the beginning of February it was carried to the district of Abdare by some Montefik Arabs from the Hai, and about 150 in the district died, out of a population of 4,000 souls. The disease did not enter the village, which consists of 50 houses. About the beginning of March the disease appeared in the village of Fowar, in the heart of the bazaar, but how it was brought there I could not find out, as the first cases were concealed, and a number of deaths had even taken place before the authorities were aware of the existence of disease; and it was not till the 9th of April, when a southerly wind set in, and 40 people were seized on a Friday and Saturday, and almost all died, that the existence of disease was declared. From that time the epidemic there decreased; and when I visited the place on the 8th of May, all the cases I saw were in reed huts on the outskirts of the mud

bazaar. The village of Fowar had a population of about 250 souls, and up to the time of my visit 43 were known to have died, though there were probably more deaths. On the 16th of April a man arrived from Fowar, and spent the night in a garden-house on the outskirts of the town of Diwaniyah, on the left bank of the Euphrates. He fell ill of plague, and died there. After a few days, exact time unknown, four of the gardener's family died, besides a little daughter, who was carried by the father in a dying state to a garden-house on the opposite bank of a river, and left there. He returned next night, and took his child, who meanwhile died, back with him. Forty-eight hours after taking the girl to the gardener's huts on the right bank of the river, the first of this man's family was seized; there were here 15 people in all, divided into four huts: in one hut, father, mother, and son died, all it contained; in another hut, a woman living by herself died; in a third hut, two girls died, leaving father and mother and one girl behind. One or two Jews went to this garden on the 28th of April, and four days after, a boy, fifteen years of age, was attacked; but when I saw him on the 7th of May, he was recovering, with a bubo on the left groin, which had burst. A soldier from the barracks close by was also attacked, after entering this garden, but was recovering when I saw him. Another soldier from the barracks, after visiting a village three hours distant, towards Shinafeah, where he entered a hut, of which, to use a local expression, the doors were shut, meaning that all had died inside, returned to Diwiniyah, and died. At Shinafeah, which has a population of about 1,000 souls, 108 people died this spring, up to the beginning of May, when three-fourths of the villagers fled into the marshes, probably alarmed by 24 people dying within three days. At Um Nejeris, up to the date of my visit on the 11th of May, 60 people had been seized, out of which 40 died, and the disease still existed in the village; though from an evident dislike to my visiting the patients, the heads of the people declared that women only were attacked, and trusted I would not insist on seeing them. As I mentioned, plague appeared on the Shat-il-Hai in the beginning of January, and it then attacked the village of Jelat-Sikker, containing about 2,000 inhabitants, and after about from 460 to 470 had died, the villagers fled, not leaving twenty-five people in the place, and a few went to Kut-il-Amarah on the Tigris, where one or two of them died, thus creating alarm. At Hai Wasut, containing about 4,000 souls, up to the beginning of May 500 people had died; and when I was in the neighbourhood the disease still existed. At Shatra, the disease appeared only about the middle of April, and was increasing in the beginning of May. From Shatra, plague was carried into Nassreah by two messengers on the 20th of April. One of the messengers died, and the other returned to Shatra. Between two and three days after the entrance of the messenger into a house in Nassreah, where he stayed, the head of that house was taken ill. Altogether, up to the middle of May, about thirty people died. At Sook-il-Shiook, the plague appeared about the middle of March, and 200 people died out of a population of 2,000, but no deaths had occurred since the beginning of May.

A triangle, with one angle at Kut-il-Amarah on the Tigris, another at Shinafeah, and a third at Sook-il-Shiook, will include the infected district, which, it will be seen, has greatly increased since last spring. It is almost impossible to give an idea of the total number of deaths in the whole district, because the natives are so given to exaggeration. But if it is supposed that half of the villages within this triangle were attacked, that the number of deaths was 13 per cent. of the inhabitants of the infected villages, and that the whole population is 12 to a square mile, this will give a little over 4,000 deaths for the two years, and I suppose it is pretty near the truth.

The symptoms of this disease are fever from twenty-four to thirty hours, but often immediately before that the patient appears more than absent, rushes along the bazaar, speaking to no one, enters his house mechanically, shutting the door, and drops on to his bed as if in despair or wandering in his mind. When fever sets in, the patient becomes stupid, his eyes are red and turbid, and he looks like a drunken man, or he is delirious, and on being asked a question, only answers with a moan. His tongue is swollen, generally blackish brown, and fissured, sometimes white or yellow. There are invariable sordes about the teeth and gums; the thirst is intense, and in certain cases, if the patient is able to answer, he complains of pain in the epigastrium, as if

being stabbed by a knife. In this epidemic there is very little vomiting, though, in certain cases, the patient vomited blood towards the end. The breathing is hurried, and the pulse during the fever stage is very rapid. The urine, as a rule, is natural, often pale and abundant, but as the case goes on, he often passes blood from the bladder. There is almost always obstinate constipation, and when diarrhœa appeared, it was looked upon as a good sign. When the fever left, the patient burst into a profuse perspiration, and became sensible, though very weak. With the fever, or oftener a few hours after it had set in, there was intense pain in the groin, armpit, or neck, and so sudden was the swelling of the lymphatic glands that the attendant often discovered a considerable enlargement on the first complaint of pain, and no case occurred in which the swelling of the glands was absent. The glands in the groin more frequently swelled than anywhere else, next to that in the armpit, the glands of the neck swelliing more rarely than any. The glands of one groin as a rule swelled, but sometimes in both groins, and indeed anywhere, it was seldom one gland only, but a chain of half-a-dozen, one being larger than the others, round, the size of a walnut, or oval, the size of a pigeon's egg. Petechiæ occurred only in fatal cases, and then only two or three hours before death. Carbuncles did not occur this year, but appeared in Diwaniyah last spring in a certain number of patients, and were looked upon as a good sign. Death occurred from two to seven days, and if the patient survived to the twelfth day, he was considered to have escaped. The mortality in the first half of the epidemic in a village was from 93 to 95 per cent. of those attacked, but during the latter half the greater number of patients recovered; and it is to be remarked, that though plague may be decreasing, and most of the patients be recovering, when the disease is transferred to another village, still that other village fares no better, as if, from some predisposing cause, a certain number of victims are marked out for destruction, while the decrease is due, not to a diminution in the vitality of the disease, but probably to the fact that all those most liable are killed among the first. It was constantly remarked that many more people fell ill during a southerly wind than when the wind was in the north, and this is an observation that was made 102 years ago, when the plague attacked Busreh. I always lay considerable stress on the opinion of intelligent people who saw the plague in 1831-32, and all agree that this was the same disease, with the exception of two men at Fowar. These two men said it was like it, but different because the carbuncles appeared, and one pulled off his shirt and showed me a large scar on his back, which had discharged matter for months after he had recovered. Again, said they, the patients then became as drunk, never recovering; while now, when the fever leaves them, they declare themselves well, often smoke, but still they die. We, however, know that carbuncles are not necessary in order to establish plague. There is one point, and before I entered those districts I was misled by it, and it is this—if this is plague, why does it spread so slowly? and it does require a visit to understand it. In the early spring, when the cultivators are ploughing and completely occupied, there is no intercommunication between one village and another, and no visits are paid from the towns, because there is no revenue to collect; and when the revenue-men do spread abroad and the villagers have less to do, the season of plague has almost ended: for I consider that between the end of May and the 10th of June it ceases, or, I should rather say, becomes dormant. In 1831, when plague ceased in Bagdad, it lingered during the summer and winter on the Shat-il-Hai, and in 1832 attacked Busreh, while but few people suffered in Bagdad that year. Here we find it last spring attacking Um Nejeris, lying dormant during the summer, appearing slightly in autumn, becoming dormant again during the severest winter that has been known in this province, and again appearing this spring. Diwaniyah, it will be noticed, suffered severely last spring, and though plague was brought to its door this spring, yet it escaped. That this is plague there cannot be the slightest doubt, but still it is a plague not properly developed; whether it will arrive at maturity next year, demands considerably thought, because Bagdad, Hillah, Kerbellah, Nejef, and Busreh, lie round the infected triangle; and if this is plague in a state of incubation, be it remembered that it will be hatched much farther east than before, for all former plagues came from Egypt or Syria.

I have already, besides mentioning the towns, described four classes of

villages or groups of huts. One class where irrigation takes place with skin buckets on account of the high bank, and the huts are on dry ground and therefore receive all the antiseptic influence of earth. In the second class the villagers only spend the season of cultivation on the ground and return to the towns for the rest of the year. In the third class the villagers are driven, on account of the rise of the water from their rice-fields, and forced to move their habitations twice a-year, while the ground they occupy during the greater part of the year is thoroughly cleansed by the rising river. Those three classes of villages are all free from plague, and the disease is confined to the fourth class only. In this class the villages or groups of huts are permanent; they are on ground which is a foot or two lower than the surface of the water in spring, and the ground is so saturated with water that the refuse of the village is neither absorbed nor can it be evaporated, for it acquires fresh moisture from the ground, and this refuse acquires the form of a bluish-black oily fluid, which surrounds the huts and covers the paths, and stains the walls two feet from the ground; and, in fact, the village is in such a state of filth that it requires to be seen to be believed. It was this class of village which was exclusively attacked in the Hindeah in 1867. It is no exaggeration to say that every hut in this class of village is a filthy pigsty; for put the pig in in the morning, and in the afternoon he will be wallowing in the mire, so moist and polluted is the ground. It may be remembered that the towns of Diwaniyah, Nassreah, and Sook-il-Shiook have been attacked by plague, but the disease was imported, not hatched there. . . . . .

I can see no reason why it should have attacked this district last spring, and this in preference to any other year; for during the past two years every kind of grain has been in profusion, dates in abundance, and fish on the Euphrates are caught simply for the sake of the oil. It may be remarked that, during last spring, there was an excess of rain as in 1867, but that could not affect villages moist as these are. Still, it is a significant fact that the only two great inundations of the rivers since 1831 occurred in 1867 and last spring, and that during the great plague of 1831 there was an inundation of the Tigris which washed half Bagdad away. In 1867, however, the disease died away in one spring, while this year the area has much increased since last year.

. . . . I cannot conclude this Report without mentioning the exceeding kindness I received from all classes and creeds along the entire route. I seldom entered a village where I was unknown, and some one at least did not thank me for professional assistance rendered him or his relations. In fact, high and low were most anxious to serve me.

Fowar.

May 8.

Case I.—Hassan ibn Abood, 25 years old.—His mother died yesterday, and n the afternoon, returning from the funeral, he was seized with fever, unable to walk, had to be put on a donkey, and was not brought home till midnight. Though intelligent in health, the patient appeared semi-comatose, very restless, and moaning, sometimes crying "Mother, mother," and he requires to be spoken to six or a dozen times before he can understand the simplest question. Lifted to a sitting position, the head rolled from side to side. He complains of pain in the groin. Drinks much water. There is no vomiting. The glands began swelling only within the last two hours, and now a chain of glands are swelling in the right groin. His tongue is white, furred, and swollen. He seems as if drunk. There are sordes about the gums and teeth. The breathing is 40 and laboured. Pulse 130; no petechiæ. Constipation. No headache. Passes water pale and natural. Eyes bloodshot and turbid. No perspiration, and the skin is hot. The mother and son were the only inmates of one hut.

Case II.—Mahommed ibn Mustapha, 50 years of age.—He is a coffee man by trade, and desired to open his shop the day before yesterday in the morning, but returned with fever, which has just left him, and he now perspires freely. Yesterday he felt the chain of glands enlarging in his left groin, and to-day they have increased, the largest being the size of a walnut. There is intense

pain, and great headache. Tongue furred, swollen, and very white; sordes about the teeth and gums. Bowels constipated. Urine scanty and high coloured. Pulse 95. Breathing 36 laboured. Eyes clear. Patient is now very weak, but sensible. Yesterday, however, he is described like one drunk. He drinks much water. No petechiæ. Has a wife and child, but no one has previously died in his hut.

Case III.—Hajee Sultan, 35 years of age.—Four days ago returned from his shop in the afternoon with slight fever, which increased in intensity, and only left him to-day. With the attack of fever the gland in the right groin swelled. Till to-day he has been delirious. He now perspires. The glands in the groin pain intensely, but not now. The tongue is black, dry, and swollen, and cracked. There is intense thirst, and sordes about the teeth. The bowels are freely opened; in fact, he has diarrhœa, and the excrement is very offensive. The breathing is 60, but not laboured, and the pulse 96. He passes much dark urine. His eyes are heavy looking, but neither bloodshot or yellow. No petechiæ. Patient very weak. He has had no vomiting.

Case IV.—Abid, a boy 4 years old.—Yesterday afternoon had fever, and this morning a mass of glands swelled in the left axilla. He only cries out "Head, head," answers no questions, and appears to understand nothing, being quite stupid, and tossing about, and he also appears frightened. Tongue, so far as can be seen, is white and swollen. The eyes are yellow and heavy. The breathing 52 laboured. Skin very hot. Pulse 150. Last night he vomited a white froth every hour, but this has ceased. The bowels are constipated. There was no urine yesterday, but to-day once scanty and dark. There are sordes about the gums and teeth. No petechiæ. He only moans, and drinks much water.

Nassreah.

Temperature of the air in the shade, 93° at the time of these visits.

Case I.—Jassim ibn Moolood, 30 years of age, and a butcher by trade.—This morning at 2 o'clock he returned home like a child without sense, mechanically shut his door and dropped on his bed, complaining of pain in the left groin. Tongue is red at the margins, white in the centre, and dry. Pulse 132, very feeble. Breathing 24. The temperature of the skin in the arm-pit, 94°. He complains of intense pain in the groin, though the glands are but very slightly enlarged, but evidently swelling. Bowels are constipated. He passed this morning about a pint of urine, with blood. The eyes are yellow, heavy, and dull. There are no petechiæ. On complaining of pain in his groin, 1½ lbs. of blood was taken from him; and, though it is said that at the moment the heat of skin left him, still he did not perspire. He answers questions with great difficulty. He is quite prostrated, and evidently at the point of death.

Case II.—Rima bint Atti, 45 years of age.—Three days ago at night she had fever, but before the fever came the glands enlarged in both groins. At present there is one gland in the left groin the size of a small orange, and the chain gradually diminishes in size. In the right groin the gland is oblong, but not so big as in the left. The swelling appeared in the left groin after it appeared in the right. Pulse 140, weak. Breathing 40, but appearently easy. Temperature of the skin in the breast 100°. Tongue red and fissured. Sordes about the teeth and gums. No headache, but moans from pain in the groins. Bowels constipated. Passed blood yesterday, twice with urine, which is natural in quantity, vomited bile yesterday, but none to-day, though she complains of bitter taste in her mouth. She answers questions readily, but when raised complains of giddiness in the head, as if a knife was stabbing her in the epigastrium. The eyes are yellow and heavy. No petecchiæ. She perspires freely, and does not drink much water.

Case III.—Zafaran, a female negro slave of an officer, 18 years old.—Yesterday at seven in the morning she said she could not work, and immediately the glands in the right groin swelled. She spoke once or twice yesterday, but not since. Pulse 147. Breathing 42, laboured. The temperature of the skin in the arm-pit 96°. On being spoken to, she only answers with a moan. Mouth

half open, tongue slightly protruding. There are sordes about the gums and teeth. The bowels are constipated. She passes urine involuntarily. Last night it was yellow, but to-day it is red, as if mixed with blood. She is too comatose to open her eyes or show her tongue.

Case IV.—Salaman ibn Jaffer yesterday afternoon was seized with headache and fever. There is no enlargement of the glands. The tongue is furred, white in the middle, and red round the margins. Urine yesterday pale and abundant. Pulse 120. Breathing 36 easy. Temperature of the skin in the arm-pit 99°. He perspired freely all night, and this morning complained of a sharp pain in the epigastrium. The eyes are white and clear. He drinks much water, but cannot taste it in his mouth. He answers questions quite readily, and in fact it does not appear a case of plague, though the attendants say it is.

I was on my way to see another patient, when I was told that he had just died, after three days' illness, and unfortunately was carried to the grave before I got there.

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